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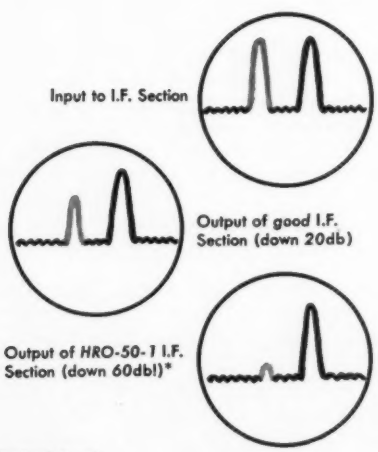
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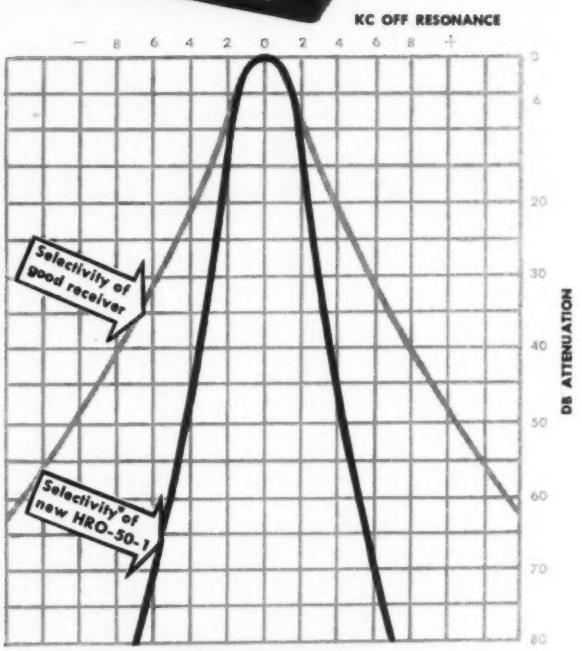

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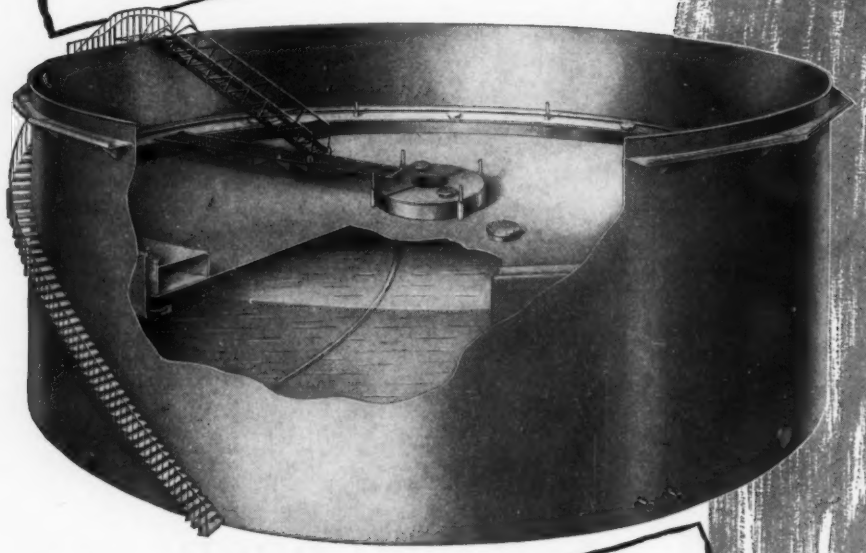

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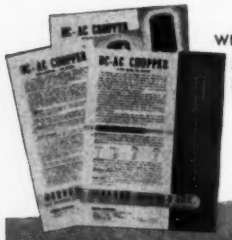

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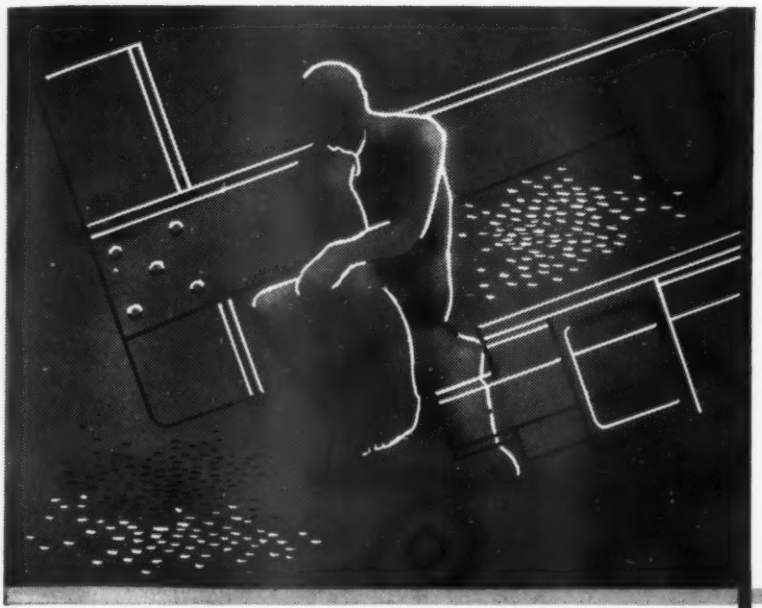
THE TABULAR VIEW

Geologically Speaking. — In these dissentious days it is sometimes good to put out of mind the latest blunders of politico-statesmen, in favor of indulging in the purifying atmosphere of communion with nature, especially if international good will can be fostered in the bargain. One highly successful venture into scholarly Canadian-American co-operation, in effect at Antigonish, St. George's Bay, Nova Scotia, is described (page 345) by JOHN J. ROWLANDS whose firsthand knowledge was gained on a trip to Acadia last summer. In earlier years, Mr. Rowlands spent some time in Canadian mines and forests before becoming New England manager of the United Press, between 1917 and 1923. Since 1925 he has been director of the M.I.T. News Service and for almost as long he has been an editorial associate of The Review. When not engaged in furthering the Institute's public-relations program, Mr. Rowlands enjoys wood carving, camping, travel, or writing. He is author of *Cache Lake Country* (illustrated by Henry B. Kane, '24).

Benevolent or Virulent? — One's attitude on what may be good or bad too often depends upon circumstances — upon whose ox is being gored. So it is, for example, with the mesquite tree which, for many decades, was regarded as an object of beauty and a hardy plant of very considerable utility. But of late this spiny, deep-rooted mimosaceous tree or shrub has come to be regarded, especially by cattlemen, as a noxious brush whose elimination is imperative. Something on both sides of this controversy is presented (page 351) by CARL C. WRIGHT who urges "an intelligent program of control rather than a program of wholesale destruction." Mr. Wright received the M.A. degree from the University of Texas in 1946 where, for the past five years, he has been an instructor in English. Mr. Wright is doing research for a book on the mesquite tree and has had articles in the *Southwestern Historical Quarterly, American Forests, The Cattleman,* and *Progressive Farmer.*

Exploded Dream. — In The Review for April there appeared the first of a two-part article portraying the saga of the long search for a vast rich land at the southern portion of the world. In this issue WILLY LEY carries the story to its logical conclusion (page 353) with the explorations of Captain James Cook, whose voyages definitely proved that whatever Southland was still unexplored had none of the value anticipated at the time. Mr. Ley is an editorial associate of The Review whose writings reflect his interest in the history and interpretation of science. He has taken his turn at newspaper science writing and scientific research. More recently he has devoted himself to lecturing and writing on current topics in science and technology, in a serious effort to interpret science for the nonspecialist. Volumes written by Mr. Ley include: *Rockets; The Days of Creation; Bombs and Bombing; Shells and Shooting; The Lungfish, the Dodo, and the Unicorn; The Conquest of Space* (illustrated by Chesley Bonestell); and *Dragons in Amber.*



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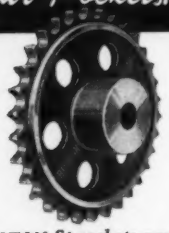

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MAIL RETURNS

When Science Was Simpler

FROM MRS. WILLIAM C. EWING, '97:

I would like to tell you how much pleasure I have had during this last year in receiving The Review. I have enjoyed the pictures, the Class Notes, and especially those articles about our old teachers, such as that in the December, 1950 issue, "William T. Sedgwick, Biologist."

Many of the technical articles I follow with interest, and those by Dr. Compton and President Killian were delightful and inspiring. Though I graduated in the days when science was a much simpler matter, and feel that I hardly have a right to claim a degree from M.I.T. as it is now, I am proud to do so.

Williamsburg, Va.

A Chemist's Guess

FROM WILLIS R. WHITNEY, '90:

Regarding covered bridges and Mr. Burt's suggestion (January, 1951, Review, page 132) of additional reasons for covering them, I'd suggest that it was principally the carefully fitted wooden upper constructions – the bridge elements difficult to replace – that it was found desirable to protect from weather and weathering which they undergo from rain, freezing, and so on during all seasons. The planks or roadway wear out anyway, but are easier to replace. A chemist's guess; not an engineer's.

Schenectady, N.Y.

Not Bored

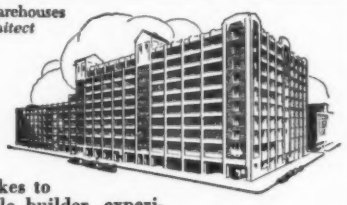
FROM GORDON G. HOWIE, '13:

Congratulations on the fine article ["The Blasted Bore"] about the Hoosac Tunnel in the January, 1951, Review. It is a long time since the author and I started our railroad work, when we produced that marvel of engineering, the bridge over the Charles River for the Belt Line Railroad, as described in our joint thesis in 1913.

I have enjoyed other articles by Mr. Cameron and realize the great amount of research involved to obtain the facts for these treatises, but more than that, they are assembled in a most interesting and readable manner.

Cambridge, Mass.

Macy's Long Island Warehouses
Robert D. Kohn, Architect



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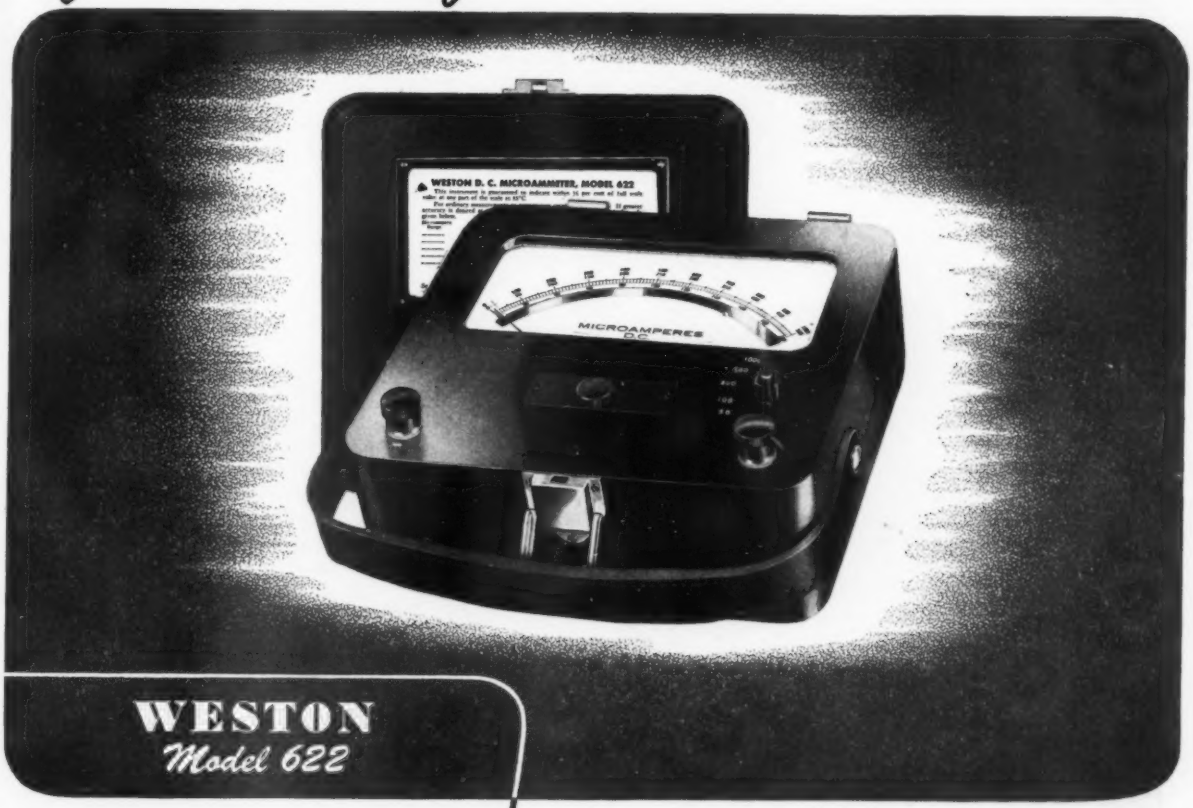

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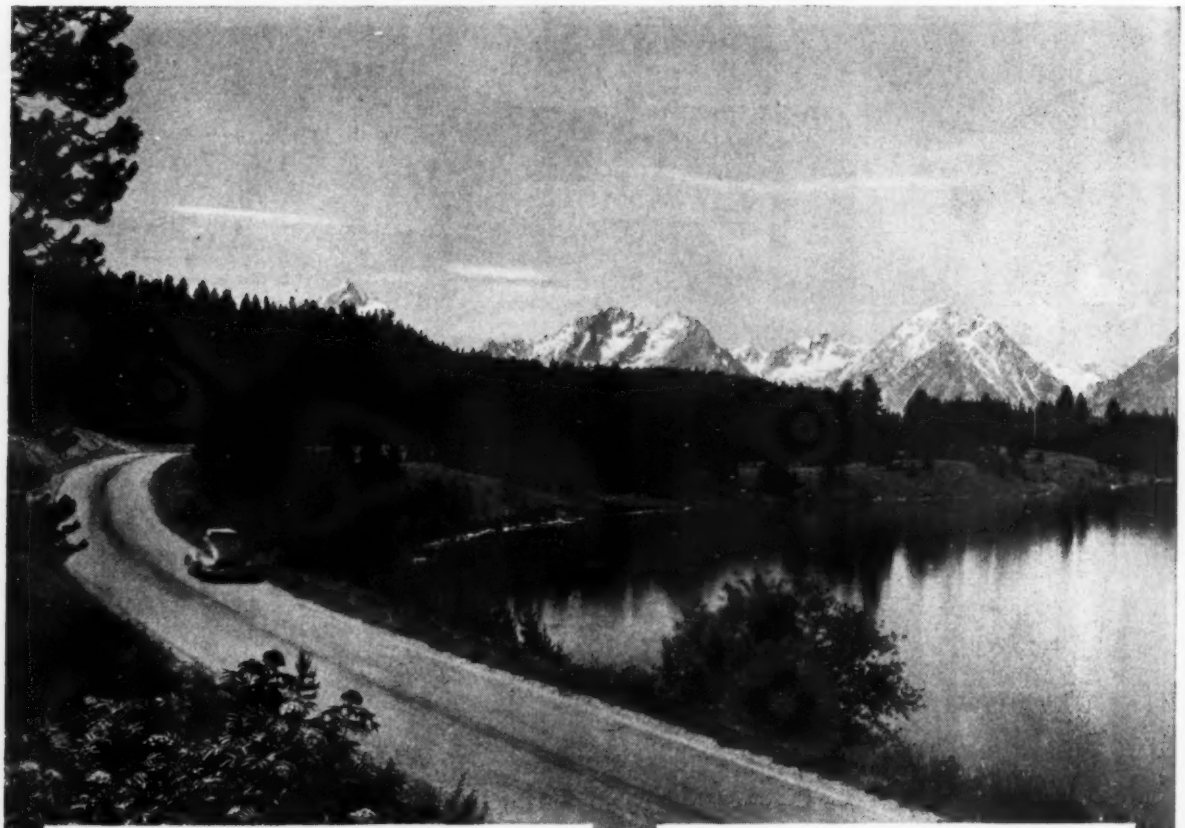

Whether motoring to Wyoming's sky-blue Jackson Lake (above) or just down to the corner store, why is it that more Americans travel on Goodyear tires than on any other kind? It's because car makers, who really know tires, put more Goodyear Super-Cushions on the new cars than any other kind. It's also because motorists find that the Super-Cushion leads in all-around performance, and buy more Goodyear Super-Cushions than any other low-pressure tire. *Doesn't it stand to reason that the tire that gives the most people the greatest satisfaction in safety, soft ride and mileage is the tire for you to buy?*

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Charles H. Hughes, '00

The Half Moon *missed this catenary.*

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Ward Allan Howe

Free Country

THE
TECHNOLOGY
REVIEW

Vol. 53, No. 7 May, 1951

The Trend of Affairs

The Violable Brain

Not so long ago the human brain was thought to be inviolable, and any injury to, or interference with, that organ was assumed to be necessarily fatal. Vulnerability of the cranium is still recognized in the continued use of combat helmets when the conditions of modern warfare have made other body armor obsolete. Similarly, protective headgear is held to be a prime means of minimizing injury from industrial accidents.

A dramatic demonstration of the fact that the human brain is not necessarily inviolable may be seen in the "crowbar skull" that is displayed in the museum of the Harvard University School of Medicine at Boston. This is the actual skull of a Nineteenth-Century workman who was tamping blasting explosives with a crowbar when the charge exploded. The metal bar was projected completely through the front of the workman's head so that a good deal of the forward portion of his brain was destroyed, as evidenced by holes in the skull marking sites of entrance and exit of the bar. Through sheer good fortune the victim did not succumb to the infection, hemorrhage, or shock that usually would have claimed anyone suffering such a degree of injury in those times, when medical science lacked much of the armamentarium for coping with trauma that it enjoys today. The workman recovered, lived for years, and suffered no apparent physical or mental impairment. His temperament, however, is reported to have become radically altered. Previous to the accident, the victim was reputed to have been a mild and reserved man, whereas afterwards he became irascible and profane.

The fact that survival is possible with part of the brain lacking is sometimes demonstrated in modern college biology lectures. This demonstration may be done by cutting out, under anesthesia, the cerebrum or front lobes of the brain of a pigeon. Barring surgical accidents, the bird survives; but its behavior is markedly changed from the normal. Usually a notably nervous and active creature, the pigeon when deprived of its forebrain becomes apathetic and lethargic. It reacts only to the strongest of stimuli, and then slowly. Left to itself, the bird sits drowsily, and never flies of its own accord. Nevertheless, when thrown into the air, a decerebrate pigeon rights itself and flies to the nearest perch. This fact is exploited by lecturers with a flair for showmanship. They allow the bird to perch somnolently on the lecture bench during their discourse, and then, as a climax, hurl the bird out into the auditorium where it takes wing and then alights, usually on the head or shoulders of one of the students.

Modern brain surgery has now, as is well known, made entry into the human skull, and operations on the human brain, relatively commonplace. Advances in the special techniques of brain surgery (thanks largely to the brilliant Harvey Cushing), plus general surgical progress in reducing deaths from shock and infection, have made such procedures as removal of brain tumors and the repair of brain injuries highly successful.

Another type of brain operation that has recently come to the fore is manipulation of the human brain for the purpose of alleviating mental disorders. Thus, in the United States during the last decade and a half, some 5,000 mentally ill persons, largely schizophrenics, have undergone an operation known as prefrontal lobotomy. In this procedure none of the brain is removed, but the frontal lobes are detached from the remainder of the organ by severing the connecting tissues. This operation has accomplished the allayment of violent individuals, and in some cases the return to the home, or even to gainful occupation as well, of patients who previously had to remain in institutions for the mentally deficient.

The large experience with prefrontal lobotomy that has now accumulated is making possible thorough analysis of the effects of this operation on personality and mental capacity. From such studies it now appears that a major change produced is loss of the ability to think abstractly. No means of re-establishing this faculty has been found. Since abstract thinking is needed to cope with many situations in today's complex society and is, in fact, one of the salient differentia that set mankind above the other animals, the gravity of this loss is manifest.

Thus today the human brain can no longer be considered inviolable, and mechanical alteration of the brain has become a useful tool for coping with mental disease. Nevertheless, in view of the crippling intellectual handicap now believed to be caused by prefrontal lobotomy in its present state of development, this operation is held to be an expedient of last resort, to be applied only when other forms of treatment fail.

Blast-Resistant Structures

THE magnitude and destructiveness of forces produced by explosion are problems that must be approached experimentally as well as theoretically. During and after World War II, extensive theoretical and some experimental researches were carried out in an effort to establish the effect of a blast or nearby explosion on buildings. An experimental investigation is presently being carried on in the Structural Dynamics Laboratory of the Department of Civil and Sanitary Engineering, to determine the behavior of structural elements under impulsive loading. This work, which is sponsored by the Office of the Chief of Engineers, Department of the Army, is being supervised by Professor John B. Wilbur, '26, and directed by Robert J. Hansen, '48, Associate Professor of Structural Engineering, both of the Department of Civil and Sanitary Engineering.

Two unique machines have been constructed in the laboratory which can produce an impulsive point load and an impulsive uniformly distributed load, respectively. Among the elements tested are reinforced concrete beams (continuous and simply supported), frames, slabs, and rectangular steel beams. Steel bolts in double shear have also been tested for impulsive loading. By a high-pressure cylinder-piston arrangement, the rapid load machine will produce a concentrated impulsive load on a structure. The load, which is applied to the structure by the piston rod, may be controlled both in magnitude and duration. An electronic timer, with appropriate electric circuits, controls the time of initiation and release of the load along with other associated events, such as starting and stopping of cameras. The events recorded during a dynamic test of a reinforced concrete beam include the deflection and load at the center point as functions of time.

A large number of reinforced concrete beams of various cross sections and with various percentages of reinforcing steel have been tested in the rapid load machine. The various events recorded during a dynamic test enable calculation of the energy absorbed by the test specimen. The static energy absorption is obtained by performing static tests on the same type of specimen; thus a relationship between static and dynamic energy absorption may be obtained.

Arthur L. Child from Black Star

Today and . . .

The results of loading on reinforced concrete beams indicate that 15 per cent to 30 per cent more energy is absorbed under dynamic loading than under static loading. Tests on rectangular steel beams show this same increase under dynamic loading. It is believed that the increase in energy absorption of reinforced concrete beams under impulsive loading is due to an increase in the strength of the reinforcing steel under the rapid rate of straining.

The ultimate aim of the present test program in the Structural Dynamics Laboratory is to establish design procedures for structures to resist impulsive loads, incorporating the parameters of behavior determined in the laboratory experiments.

Ferroelectrics and Ferromagnetics

Two series of isomorphous substances, which have an important variety of interactions with electric, magnetic, and mechanical fields, have been studied extensively at M.I.T. They are represented by magnetite ($FeO{\cdot}Fe_2O_3$) and barium titanate ($BaTiO_3$). The former – lodestone – is the oldest magnetic material known to man, but its technical significance has only recently been fully recognized. The ferroelectricity of barium titanate, however, was discovered but eight years ago.

Isomorphic with each of these are a variety of crystals, respectively called ferrites and perovskites. All of these substances may be prepared as strong ceramics by casting, molding, or extruding; and they promise to become increasingly useful in instrumentation, power devices, and radio and radar communications. They have application as crystal pickups and other electro- or magnetomechanical transducing devices, such as strain gauges, accelerometers, electro-optical or thermosensitive devices, and delay lines with delay times that may be made to depend upon temperature or field. These materials are effective in reducing the bulk of capacitors and as high-frequency magnetic cores. As nonlinear devices, they may serve as field-controlled tuning capacitors, or as electric or magnetic units which "remember" whether or not they have received a previous electric, magnetic, thermal, or mechanical signal.

Research on the fundamental physical properties of these substances and consideration of their applicability is being actively pursued at the Laboratory for Insulation Research, under the direction of Professor Arthur R. von Hippel of the Department of Electrical Engineering. This research, which is sponsored by the Office of Naval Research, the Army Signal Corps, and the Air Force, spearheaded the development of barium titanate ceramics and the study of the fundamental properties of barium titanate single crystals. These ceramics have dielectric constants of several thousand, and strongly piezoelectric properties can be induced in them by the momentary application of an electric field. They are being used in lightweight capacitators, phonograph pickups, and sonic and ultrasonic devices. Recently, large single crystals of magnetite have been grown from the melt, and extensive studies have been made of their static and microwave magnetic properties. The growing of large barium titanate single crystals is also under investigation.

H. Armstrong Roberts

. . . *Yesteryear*

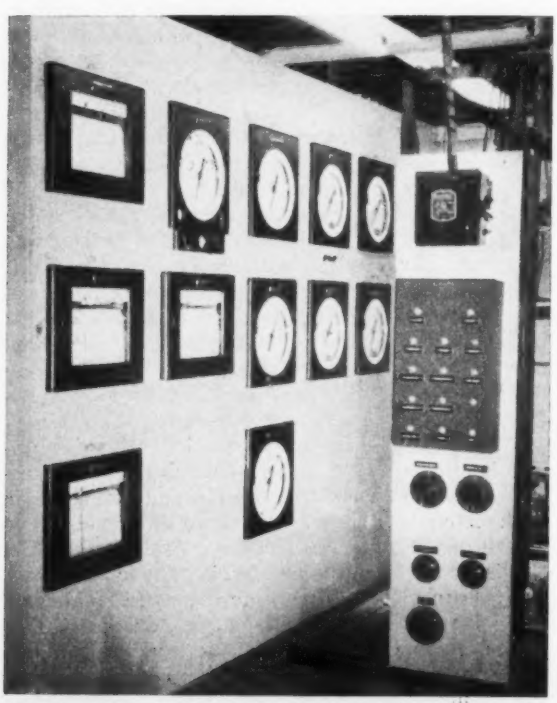
Barium titanate and magnetite have the property in common that, below a certain Curie temperature, their crystal structures acquire a spontaneous electric polarization and a spontaneous magnetization, respectively. The best known crystal exhibiting spontaneous magnetization is iron, hence the names ferroelectric and ferromagnetic. Unlike iron, magnetite is a nonmetal and its poor electric conductivity minimizes eddy current losses. While a crystal structure may spontaneously polarize or magnetize, a single crystal of such a compound usually divides into regions or "domains" differing in the direction of this spontaneous dipole movement. Such substances exhibit hysteresis in their response to applied fields; that is, their condition after the application and subsequent removal of a field differs, in general, from their condition previous to this treatment. They also have abnormally high magnetic or electric susceptibilities.

One of the present tasks of the Laboratory for Insulation Research is to find out enough about the processes of polarization, magnetization, and conduction in such materials to allow insulators to be tailor-made to almost any desired specifications. Aside from direct studies of ferroelectrics and ferromagnetic nonmetals, the research includes work on dielectric breakdown and high field strength phenomena, on the gradual transition from insulating to semiconducting and metallic properties, on crystallographic structures of new compounds, on dielectric and optical spectroscopy, and on paramagnetic and ferromagnetic resonance phenomena at microwave frequencies.

Servotechniques in Industry

THE increased importance which automatic control systems play in operating giant industrial processes has brought about the need for a re-evaluation of process control system techniques, analysis, and design. A firm basis for modern process control system principles of analysis and synthesis must be established before a quantitative study can be made of the improvement in the yield of a process plant, achieved by the lowering of waste during continuous manufacturing, or before direct control can be established over the quality of products or materials produced by chemical synthesis plants.

Servomechanism theory has reached a degree of advancement wherein many industrial processes can be studied upon a thoroughly quantitative basis. Measuring apparatus, amplifier equipment, high-power machinery serving to manipulate the process, and the process, itself, can be treated according to well-established patterns of mathematical analysis. By bringing the study of automatic process control systems within the scope of servotechnique, a direct approach can be made to the development and synthesis of a wide variety of control schemes. Multiple variable types of environment controllers can be designed; certain quality parameters, which measure the usefulness or market acceptability of a product, can be brought under feed-back control; and from carefully planned studies of analysis and synthesis, combinations of environment and quality controllers often emerge in such a way that quality control has dominance over environment control. Quality and environment control systems may be brought under a still higher stratum of automatic control; namely, supervisory control, which serves to optimize the plant operation under conditions of continued external disturbances, variable purity of raw material, changing weather, and varying production schedules.



Improvements in continuous process manufacturing may be expected to stem from automatic process control studies of a chemical pilot plant whose control panels are shown above.

Along with the theoretical studies in feed-back control systems which have been in progress at the Institute for several years, an experimental program has been inaugurated to insure that the new investigations of industrial process control follow a sound scientific path. The Departments of Electrical and Chemical Engineering are fostering this activity in an interdepartmental research program which makes fullest use of the Institute's educational and research resources. The staff members who are active in carrying out this new type of process control research are: Donald P. Campbell, '43, Assistant Professor of Electrical Engineering, who is in charge of the project; Paul E. Smith, Jr., G., and Leonard A. Gould, '48, instructors; and Raymond C. Quick, '50, a research assistant – all of the Department of Electrical Engineering. Professor Harold C. Weber, '18, of the Department of Chemical Engineering, and Professor Gordon S. Brown, '31, of the Department of Electrical Engineering, have been acting in an advisory capacity for the program.

The present laboratory investigation is designed to study the application of servocontrol techniques to chemical processing plants. To this end, a small-scale chemical distillation plant has been constructed, with the aid of the Brown Instrument Company, upon which dynamic response tests can be carried out in order to confirm the general theories of distillation dynamics. Both the experimental and theoretical studies are proceeding on a reasonably wide front in investigations of the conditions of boiling, condensation, and heat exchange in nonhomogeneous media. It is hoped that results of this work will ultimately lead to means for designing unit process systems upon a basis of dynamic rather than of steady-state equilibrium.

To date, the column has been tested in steady-state operation, and some transient tests have been made on the system which indicate the thermal gradients in the column during start-up and shutdown. Dynamic response studies, which utilize frequency-response technique of measurement, will be carried out at Technology by summer.

Flutter Speed Safely Determined

A NEED has long existed for a technique of finding the flutter speed of actual aircraft by means of flight tests which do not subject test pilots or airplanes to undue hazard. Recent research, completed in the Institute's Department of Aeronautical Engineering by Martin D. Schwartz, '47, and Donald L. Wrisley, 6-45, of the Division of Industrial Coöperation, gives promise of permitting the flutter speed of aircraft to be determined with greater certainty than is possible by current procedures, which sometimes prevent high-performance aircraft from attaining their full capabilities when they are in operation because of overconservative restrictions.

Flutter is a spontaneous, self-excited, divergent oscillation of the wing that occurs when the aerodynamic forces and moments arising from the wing's motion

(*Continued on page 380*)

Walter L. Whitehead, '13

Once the manor of a tranquil seaside farm, this fine old house, now headquarters for the Nova Scotia Center for Geological Sciences, looks out across St. George's Bay to the dim outline of Cape Breton Island — 20 miles to the north.

Acadia — Place of Plenty

Canadian and American Students Find Ample Opportunity to Cement International Friendships while Studying Nova Scotia's Unusually Varied Geology

By JOHN J. ROWLANDS

FEW visitors to Nova Scotia are aware of the importance and variety of its mineral resources or realize that Canada's most easterly province rests upon some of the earth's oldest rocks. Geologists, however, have long found Nova Scotia's hills, its coastal slopes, and rugged headlands a stimulating and fruitful field for study.

In fact, while studying the petroleum reserves of Nova Scotia several years ago, two M.I.T. geologists encountered most of the scientific and practical problems that geologists face in practicing their profession. As their investigation continued they became convinced that the region was an ideal location for field training in geology, with the added advantage that such a program could be carried on in close association with active prospecting as well as long-established mining operations.

The geologists who conceived the idea were Walter L. Whitehead, '13, Associate Professor of Geology, and Professor Robert R. Shrock, who is now head of the Institute's Department of Geology. They discussed their ideas with Nova Scotian educators and officials of the provincial government, and further study led to specific proposals for a summer school for training and research in geology. As a result, in 1948, the Nova Scotia Department of Mines and M.I.T. joined in establishing the Nova Scotia Center for Geological Sciences at Crystal Cliffs on St. George's Bay in the northwestern part of the province.

The plan on which the Center operates is a simple and straightforward one. The Government of Nova Scotia provides facilities for, and bears the expense of, the summer geology field training center. M.I.T. directs the program and provides a teaching staff for undergraduate and graduate instruction based on the requirements of its own curriculum. The school is open to qualified students from Canadian colleges and other educational institutions. In return the Nova

Fishing vessels entering Antigonish Harbor get this view of the Geological Center with its cottages, used by students and staff, along the shore, and the manor beyond against a backdrop of the spruce-clad hill.

Scotia Department of Mines has the opportunity of presenting problems associated with the discovery and development of mineral resources and thus benefits from the field studies, research, and reports of the staff and the students who participate.

The curriculum covers a period of eight weeks, of which the latter part is devoted to practical field mapping and detailed geological studies in various parts of the region. During the working week most of the students live under canvas in outlying camps, where they quickly adapt themselves to the requirements of outdoor living. Each party works under the direction of a student leader, a system which, in addition to its value in teaching geology in the field, is effective in developing qualities of resourcefulness, responsibility, and leadership.

A fine old Canadian homestead, Crystal Farm, standing on the shore of St. George's Bay was chosen as an ideal location for the Geological Center. The homestead, which takes its name from the towering gypsum cliffs along its shore, lies nine miles north of the historic town of Antigonish, a Micmac Indian word meaning "the place where branches were broken off the trees by bears gathering beechnuts."

The buildings of the Center stand on a magnificent tract of 650 acres of forest and fields bordering on Antigonish Harbor. The headquarters is a fine old manor house, the original interior walls of which are built of logs and filled with tamped clay. Its massive stone foundation was quarried from nearby limestone deposits and the water-struck bricks of its walls were made nearby from the fine red clay that is characteristic of the region. Although most of the signs of a working farm disappeared when the property was converted to its present purpose, the caves in the nearby gypsum cliffs, in which ice is found throughout the year, recall days of abundance when the meat and produce grown on the farm were stored in these glistening gypsum refrigerators.

A large barn which was built only a few years ago was completely remodeled to serve as a spacious auditorium seating 200. It is completely equipped for lectures, large technical conferences, and concerts, as well as motion-picture and theatrical entertainment, and with its huge fireplace is the center of the academic and social life at Crystal Farm. The basement has been fitted for geological laboratory work, photography, and for the storage of specimens and supplies.

Members of the staff as well as students are housed in a number of modern cottages which bear the names of famous geologists. A separate residence has been built for the director of the Center, and the most recent addition is a large dining hall with accommodations that provide for an increase in enrollment for several years.

Unless they are at very remote camps, student parties usually return to the headquarters at Crystal Cliffs at the end of the week to work up their notes and consult with members of the staff, who in addition to lectures, visit the camps to supervise the program. Geological studies in the region have been the subject of several important theses which have added to the knowledge of the geology of Nova Scotia.

Last year the Department of Mines held an international conference on coal resources which brought representatives from many of the great coal-producing centers of the world. The success of this conference and the unique facilities which make the Center eminently suitable for such gatherings indicate its use for many such meetings in the future.

The Center had 54 students last year, including (in addition to students from the Institute) representatives from Rutgers University, the University of Notre Dame, Franklin and Marshall College, Williams College, St. Lawrence University, and Amherst College. Nova Scotia colleges represented were the Nova Scotia Technical College, St. Francis Xavier University, and Acadia University. Students at the graduate level

included five who were working for the master's degree and three for the degree of doctor of science. Indications are that applications for the summer geology school will increase.

Dr. Whitehead has been director of the summer geology school since it opened and has been active in its expansion to meet the needs of a rapidly increasing group of students. Members of the Institute's Faculty who served on the instructing staff last summer include: Harold W. Fairbairn, Associate Professor of Geology; Louis H. Ahrens, Assistant Professor of Geology; Patrick M. Hurley, '40, Assistant Professor of Geology; and Roland D. Parks, Associate Professor of Mineral Industry.

Responsibility for administering the Center has been shared by Donald J. MacNeil, Professor of Geology at St. Francis Xavier University, who serves as secretary and represents the Nova Scotia Department of Mines, and Dr. Whitehead. They have labored together with enthusiasm and wisdom, and the early success of the project reflects their careful planning and effective direction.

The Center is governed by a board composed of the Honourable Alexander H. MacKinnon, Minister of Mines; John P. Messervey, Deputy Minister of Mines; Dr. Whitehead; Dr. Shrock; Dr. MacNeil; Harold D. Smith, President, and Robert D. Howland, Vice-president of the Nova Scotia Research Foundation; Allan E. Cameron, President, Nova Scotia Technical College; and M. Bancroft of Acadia University; as well as Norman Parlee, Director of Research, Dominion Steel and Coal Company, Sydney Mifflin of the Dominion Steel and Coal Company; J. H. L. Johnstone, Head of the Department of Physics, Dalhousie University, and Norman Avard of Joggins.

Angus L. Macdonald, Premier of Nova Scotia, and the Nova Scotia Research Foundation have encouraged the program of the Center and expansion of its objectives by their concern for the most effective development of the province's resources.

The region in which the Center stands is not only interesting geologically, but is rich in the lore of the early and troublesome days of the province. The venturesome souls who came to settle the new land faced the hazards of hostile Indians, long and bitter winters of deep snows and North Atlantic gales, and later the depredations of privateers who roved the western ocean and raided the lonely settlements for loot and provisions. But the pioneers clung to their footholds on the edge of the sea and while they slowly cleared their farms they learned to live on what the sea provided in great abundance. To this day many of the farmers of Nova Scotia divide their time between working the land and offshore fishing or gathering lobsters and oysters. In summer their nets are set along the shore to catch salmon returning to spawn.

Right: *Many of the most interesting geological formations lie along Nova Scotia's north shore. Here two students examine a specimen with the open reaches of the Gulf of St. Lawrence lying beyond.*

Left: *Wash-up time at Camp Williams, one of the most picturesque outlying camps where students live during their field studies. Usually, those conducting field studies return to headquarters, Crystal Farm, for week-end consultations.*

The first British settlement at Antigonish was established by disbanded officers and soldiers of the Royal Regiment of Nova Scotia Engineers in 1784. Seven years later and again in 1796, Highland Scottish immigrants came to Nova Scotia and settled along the coast in the region of the town. Other Scottish settlers followed and their names are perpetuated by their descendants to this day.

This region which lies within a radius of approximately 50 miles of the Geological Center includes Cape Breton Island and the mainland of Nova Scotia from the Strait of Canso to Pictou on its western shore. Crystal Cliffs is located in a section which offers innumerable practical geological problems, and thus provides students with the type of experience they will find most useful in practicing their profession. Cape North, which stands at the western side of the entrance to St. George's Bay, is a towering headland that looks northward across Northumberland Strait to Prince Edward Island and the Gulf of St. Lawrence. To the east, across water as blue as the Mediterranean, looms Cape Breton Island which is separated from the mainland by the Strait of Canso.

The area contains various types of rocks, ranging in age from extremely ancient formations to comparatively recent deposits of the glacial period. It is a region of mines and quarries where evidence of several minerals has been found and some petroleum is being produced. Here it was that some of the earliest geological research in North America was carried out.

Sir John William Dawson, the distinguished geologist, carried on intensive field studies from 1843 to 1856, and later reported them in his classical monograph, *Acadian Geology*, which chiefly concerns the geology of the shores of Northumberland Strait and Cape Breton Island. In this monograph Sir John discussed the origin of the term "Acadia," which has often been attributed to the early French settlers. It is, according to Sir John, a Micmac Indian term meaning "plenty here." His source of information was an old Micmac Indian, Martin St. Pierre, whom he had known in his boyhood.

In 1845 Sir William E. Logan, the first director of the Geological Survey of Canada, described what are now the famous Joggins coal deposits on the Bay of Fundy. Sir William uncovered tree trunks with their roots thrust deep through the coal seams into the underlying shale. Another famous geologist who studied Nova Scotia during a field trip in July, 1859, was William Barton Rogers, founder of M.I.T. — the scientific school which was not to open in Boston until six more years had elapsed.

Thrusting far out into the Atlantic in the rough outline of a dog baying at Newfoundland across Cabot Strait, Nova Scotia lies close to the great continental shelf. Through the ages in which the North American continent gradually took form, this region was subjected to most of the telluric violence which changed the shape of the earth's crust.

Beneath the scenic beauty of the province lie rocks of ages ranging from the Mesozoic to the Pre-Cambrian period which are largely covered by a deposit of glacial drift that forms the foundation for its luxurious forests and pasture lands.

The oldest rocks in Nova Scotia, formed before any record of life began, are classified as Pre-Cambrian and are thought to have been created by erosion from a land area that once stood in a great inland sea.

As time measured in geological ages went on, the sea bottom and foreshore lifted above the water level, thus producing by erosion material that eventually became the rocks of later geological ages. So it was that rocks of the Pre-Cambrian era contributed to the Cambrian. The latter, with older rocks, contributed to the younger Paleozoic structures, and these in turn became part of the sediments of the Mesozoic era.

During hundreds of millions of years the sea level changed many times, resulting in the creation of several seaways with marked changes in intervening land areas. These upheavals were associated in some localities with violent eruptions of molten liquid rock from the interior of the earth, and the spreading of the lavas over the sea bottom changed the composition of the sediments that had already been deposited.

NOVA SCOTIA GEOLOGICAL TIMETABLE

ERA	*PERIOD*	*YEARS AGO*	*CHARACTERISTIC LIFE*
Mesozoic	Triassic	170 million	Age of reptiles
Paleozoic	Carboniferous	220 million	Great coal age, Abundant plants
	Devonian	300 million	Primitive fishes, First known land plants
	Silurian	350 million	Age of invertebrate animals
	Ordovician	400 million	First primitive vertebrates
	Cambrian	500 million	No known land animals
Proterozoic		600 million	Primitive life
Archeozoic		to 2 billion	No determinable fossils

The geology of Nova Scotia is a complex one because of the accumulation of these thick layers of sediments, and the successive upheaval and erosion of the land which produced the forms in which they appear today. The ranges are made up largely of rocks that were formed originally from sand, mud, and calcareous ooze in a fairly horizontal stratification in what must have been a great inland sea. As the bottom of this sea slowly subsided, layer after layer was added. The composition of these sediments and the thickness of the layers were apparently controlled by distance from the shore, depth of water, and the composition of the various deposits.

In these sediments were buried specimens of the plant and animal life existing at the time, and now in the form of fossils they help in reconstructing the history of the land through the ages. In the Pre-Cambrian rocks are found the primitive invertebrates, Algae, the earliest known fossils, which are followed by those of the age of shelled or higher invertebrates. Fossils of fish first appear in the Silurian and Devonian rocks, and the creation of pools of petroleum is attributed to enormous concentrations of marine growth trapped in inland seas or basins.

The age of amphibians and tree-like forms came with the formation of the Carboniferous and Permian rocks, and it was in the Carboniferous age that Nova Scotia's great deposits of gypsum, limestone, and salt were formed. It was during this period that the luxurious plant growth, which thrived under semitropical conditions, produced the materials which later formed the great coal resources of the province.

After the Permian age, came the rocks of the Triassic, Jurassic, and Cretaceous ages, the heyday of reptiles and dinosaurs. Of this geologic group only the rocks of the Triassic period have been recognized in Nova Scotia.

Grooves, or striae, formed by the glacial ice in its ponderous progress across the land, are found in exposures of bedrock at various places in the province. The best known of these are at Point Pleasant Park at Halifax. The glacial drift becomes so heavy in some parts of the province as to form dome-like hills called "drumlins." Several of these occur in Halifax, including two islands in the harbor, and more than 200 drumlins may be seen in the Mahone Bay region. Their locations indicate that the glacial ice moved in a southeasterly direction. The glaciers also left telltale signs of their progress in the form of eskers, narrow ledges of sand and gravel, a long chain of which is found in the vicinity of the Sydney River from East Bay to Sydney Bridge.

The well-preserved stumps of trees that formed a forest ages ago and were drowned by the sea are found at several locations along the shore of the Bay of Fundy. The stumps of trees, still firmly held by their roots, are to be seen at St. Lawrence and at Yarmouth at low tide.

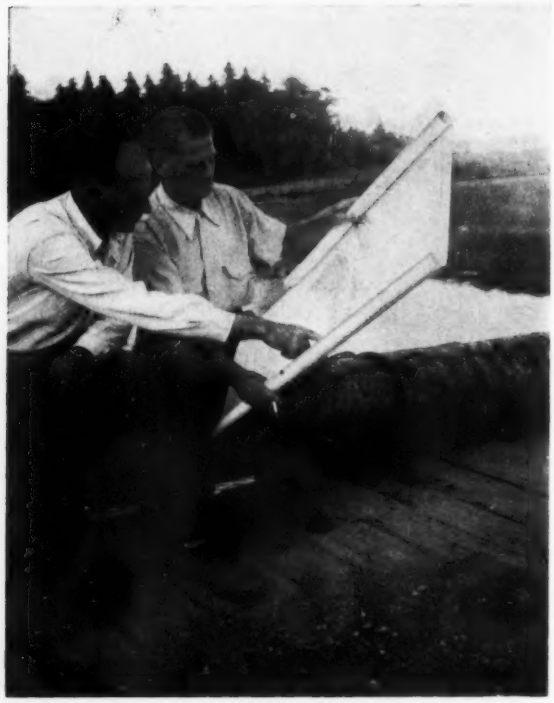
Along the northern shore of Nova Scotia on the Bay of Fundy is the North Mountain Range, which is composed of lava, or what is known as "trap" rock. This range stretches from Cape Blomidon to Brier Island, a distance of 120 miles, and is crossed by tidal gaps at three points, Petite Passage, Grand Passage, and the well-known Digby Gap. The North Mountain

The cathedral-like stope with crystal pillars of salt deep in the Malagash Salt Mine in northwestern Nova Scotia.

Range and the Cobequid Range to the northeast of it are separated by Minas Channel and the Minas Basin. The Cobequid Mountains reach from the end of the Bay of Fundy to the vicinity of Pictou at a distance of more than 70 miles. There mountains are composed chiefly of crystalline rocks, such as granite, syenite, diabase, and felsite. Further to the northeast, where the Cabot Trail circles the northern part of Cape Breton Island, are found the remains of an ancient Atlantic upland which forms a 1,200-foot tableland. In this region lies the Cape Breton Highlands National Park which offers some of the most magnificent scenery of eastern North America.

If the Norsemen, as some believe, landed on Nova Scotia about the year 1000 A.D., they may have seen the dark outcropping of coal seams along the coastal cliffs of Cape Breton Island. Whether John Sebastian Cabot, who visited Nova Scotia in 1498, discovered coal no one knows. However, Nicholas Denys, who was appointed governor of the province by the King of France in 1637, was quick to report that "there is a mountain of very good coal four leagues up Sydney Harbor, of a quality equal to any in France."

Nova Scotia's coal fields are among the important deposits of the continent and are a valuable economic resource for eastern Canada. The coal is bituminous, and while the quality varies according to location, the coal from the Sydney area on Cape Breton has proved valuable for blast-furnace coke and is used in large quantities by the steel mills in that region. This includes the famous Bras d'Or Lake district, Sydney Mines, New Waterford, Glace Bay to Morien in Cape Breton County. There are also mines at Chimney



Donald J. MacNeil (left) *Professor of Geology at St. Francis Xavier University, and Walter L. Whitehead, '13, Associate Professor of Geology at M.I.T., who together share in the direction and progress of the Geological Center.*

Corner, St. Rose, Inverness, Mabou, and Port Hood in Inverness County. The Pictou mining region includes Westville, Thorburn, and Stellarton, where the mines are the deepest coal workings in the world. There are also important mines at Springhill, Joggins, River Hebert, Maccan, and Chignecto in Cumberland County in the region adjacent to New Brunswick.

Many of the coal seams of the Sydney region dip seaward, and the workings of a number of mines extend several miles from shore beneath the ocean.

Nova Scotia's coal production in 1949 amounted to 6,196,322 tons, and, in addition to supplying an important part of the needs of eastern Canada, the province shipped a considerable tonnage to the United States and South America.

Next in importance to coal is Nova Scotia's production of gypsum, of which the province has one of the largest deposits on the continent. This is the source of more than 92 per cent of Canada's supply of this important mineral. Enormous quantities of gypsum are shipped to the United States, which is the principal market, and the reserves will meet all requirements for years to come. Gypsum has been mined in Nova Scotia for more than a century and was an important product during the Revolutionary War, when farmers found it profitable to quarry the rock by hand from their own lands. Production in 1949 was 2,558,891 tons.

The gypsum deposits of the province originated in the Carboniferous age and are found in association with limestone and other rocks. The deposits range in thickness from a few feet to approximately 200 feet. The chief use for gypsum, or calcium sulphate, is in the manufacture of plaster and wallboards, but it is also an important ingredient of thermal-insulating materials and of Portland cement.

In the form of ornamental stone, which is suitable chiefly for interior decorations, gypsum is known as alabaster, and it is also the chief constituent of plaster of Paris. The paper industry also uses very finely pulverized gypsum as a filler, and it is employed for the same purpose in the manufacture of certain textiles, as well as in paints, insecticides, explosives, cosmetics, chalk, linoleum, and oilcloth.

Salt is an important mineral resource of Nova Scotia and is produced both by mining and by evaporating brine pumped from drilled wells. Most of the salt produced in Canada is used for agricultural uses and dairy products, and for the preservation of meats and fish. The production in 1949 was 85,090 tons.

Although farmers made use of the salt springs much earlier, the commercial production of salt in Nova Scotia apparently began about 1813, when a two-foot shaft was sunk near a salt spring in Pictou County. Although this operation was not successful, brine from the nearby spring was later used for the manufacture of salt. One of the largest of Nova Scotia's salt mines is at Malagash, and others are found in widely separated parts of the northern section of the province. One of the largest is at Nappan, where two holes were drilled and salt was struck at a depth of 812 feet. This operation is capable of producing 170 tons of salt a day by means of evaporators. In holes drilled in search of petroleum, salt has been encountered at depths of more than 1,000 feet in zones several thousand feet thick. In the Mabou region in Inverness County, the salt zone reached from a depth of 1,395 feet to the bottom of the hole at 5,579 feet. In another operation, salt was found at 4,480 feet and had not been penetrated when drilling operations were stopped at a depth of 6,869 feet.

While Nova Scotia is not distinguished for the production of gold, the metal is widely distributed throughout the province and has been mined from at least 1860, and possibly earlier. Indications are that the province has large bodies of gold-bearing ore of low or medium grade. The production of gold in 1949 was 105,750 ounces, and the total production from 1862 to the end of 1949 was 1,143,360,112 ounces. The undying lure of gold keeps prospectors active, however, and the search for promising outcrops of gold-bearing rock goes on continually.

The wide variety of Nova Scotia's minerals is a challenge to further study and research on ways and means to make it profitable to mine and process deposits which have little economic value under present methods of treatment. In the work of the Nova Scotia Center for Geological Sciences lies not only new hope of developing these resources, but the expectation that it will lead to the discovery of new and richer deposits of minerals, as well as petroleum, for all of which there are encouraging geological signs.

Whatever the Center may accomplish in the field of economic geology it will be no more important and heartening than the significance of this joint enterprise of academic and governmental groups of two great countries sharing in the truest sense of international good will the fruits of friendship and technological progress.

The Mesquite Tree and the Southwest

Long Praised for Its Beauty and Great Usefulness, the Hardy Mesquite Is Now Being Fought as a Merciless Invader of Cattle-Grazing Land

By CARL C. WRIGHT

FROM the period of exploration and conquest in the Sixteenth Century to the present era of industrial development, the mesquite tree is the Southwest's most impressive figure in the family of woody plants. Though recent control and eradication of mesquite for better livestock ranges may threaten the tree's prestige, its significance in primitive culture and history is indeed far-reaching.

A godsend to Indian and pioneer, the mesquite has been praised for its usefulness and its beauty; and until the rise of extensive livestock industries in the 1930's, the tree was rarely regarded as a menace. Today most livestock producers and ecologists look upon mesquite as noxious brush, a merciless invader which robs the range lands of valuable grasses, and causes difficulty in the handling of cattle. That range owners have reason to be concerned can hardly be denied, since about 50,000,000 acres of grassland in Texas alone are said to be infested. But it is hoped by many people of the Southwest that an intelligent program of control, rather than a program of wholesale destruction, will be followed.

This stand is valid, they say, if only for practical reasons. Soils with a scanty grass cover which are subject to blowing would not be helped through the elimination of shrubs and trees, owing to the danger of wind and water erosion. But there are other reasons; appreciation for the beauty of the tree is felt by thousands of people, and few who know the Southwest's history fail to recognize the tree's significant role.

Defenders of the mesquite tree praise its good qualities. The tree produces a nutritious bean relished by livestock; it greens out in the spring and furnishes tender twigs for grazing; and the leaves are a forage, especially during droughts or before grasses are abundant. Mesquite wood is an excellent fuel and a durable material for fence posts. As a tree or a shrub, mesquite helps to prevent soil erosion. It provides a desirable shade for stock in a climate where a burning sun is characteristic. Its flowers are a source for pure, white honey. And some ranchmen claim that the tree's long roots draw underground water to the surface during droughts and encourage the growth of grasses.

When seeds of the mesquite were sent in 1930 from Honolulu to Bahrein, a small island off the coast of Arabia, this plant had encircled the globe. From Chile and Brazil in South America it ranges north to south-central Kansas, flourishing especially in Texas, New Mexico, and Arizona, and is found in the West Indies, Australia, Africa, Persia, and India. A member of the mimosa family, the mesquite belongs to the genus Acacia, of which there are about 300 species. The three varieties in the United States are generally classified as: honey mesquite (*Prosopis juliflora var. glandulosa*); velvet mesquite (*P. juliflora var. velutina*); and western honey mesquite (*P. juliflora var. Torreyana*).

Typically a shrub or a tree, mesquite varies in growth habits, which are affected by climate, moisture, and soils. In fertile land it may reach a height of 40 feet and attain a trunk diameter of nearly three feet. Although frequently low-spreading with crooked branches, it is rarely symmetrical in shape. Whether a thorny shrub, a cluster of switches, or a tree, it has a well-developed root system, vertical and lateral roots growing to enormous lengths. Pioneers who found gnarled mesquite on the dry plains decided that fires had driven this tree underground; they "dug for wood" in "subterranean forests."

Random glances at the mesquite in history reveal its usefulness to mankind. An early account of the mesquite bean as food is found in Cabeza de Vaca's narrative. Indians filled a dirt hole with beans and ground them into a meal with a wooden pestle. The meal was transferred to baskets and covered with water. A banquet followed this simple process, which for several hundred years was known to various tribes of American Indians. A writer in the *Report of the Commissioner of Agriculture* for 1870 describes the food products of Indians with special emphasis on mesquite beans:

> They are not only nutritious, but a preventive of thirst, having an agreeable blending of acidity and sweetness, somewhat like the early harvest apple. The pods, when in their fresh ripe state, are put into a wooden or stone mortar and bruised, then emptied into an earthen dish, mixed with water and allowed to stand for a few hours, the result being a cold porridge or mush . . . As the fruit or bean-like pods ripen they are gathered for winter use, being thoroughly dried and stored in cylindrical-shaped baskets . . . The Indian women pound the dry pods until reduced to a fine powder, which being mixed with a little water, is pressed into large thick cakes of several pounds weight, and dried in the sun, to be used as circumstances require.

George Wilkins Kendall, a member of the Santa Fe expedition, which left Austin, Texas, in 1841, states in his journal that when "provisions and coffee fell short," the men ate mesquite beans "raw in immense quantities, and also either roasted or boiled them." The Mexicans used beans in making "beer as well as sugar."

Long before the middle of the Nineteenth Century, as Josiah Gregg states in his *Commerce of the Prairies* (published in 1844), the mesquite tree in the Southwest had "attained some celebrity." Books written by Spanish naturalists on the plants of New Spain soon after the conquest of Mexico by Cortes show that most uses of the *mizquitil* originated with the Indians, who gave what they knew to the Mexicans. And Americans entering the unsettled Southwest were amazed at the foods and remedies furnished by a tree which reminded them of the peach tree of Kentucky and Georgia. Indians and Mexicans not only used the bean for food, but also the leaves, bark, and gum for remedies in various diseases.

In 1854 William B. Parker traveled through unexplored Texas on an expedition commanded by Captain Randolph B. Marcy and published a book[1] which gives impressions typical of many sojourners. "The tree grows singly," he notes, "and at such regular intervals as to resemble a plantation, and so much like a peach orchard that one cannot divest himself of the idea . . ." He tells an amusing story of a teamster "who one evening . . . with a load of stores, got behind the train, and on coming into camp without his team, was asked where he had left it. 'Out in that old peach orchard,' was his reply."

Parker also observes that mesquite wood "burns readily with a clear flame, leaving a very hot and perfect coal, like hickory." His greatest interest, however, was in the commercial possibilities of the gum he saw exuding from the tree, an amber product which even today receives the attention of chemurgy. "The subject of employing the Indians, in collecting this gum, was seriously entertained by gentlemen on the frontier . . . and no doubt the experiment will be made with every probability of profitable success. . . ."[2]

Whether this particular project succeeded is not known, but the *Report of the Commissioner of Agriculture* for 1872 shows that in 1871 the gum was "an article of export, some 12,000 pounds having been gathered in Bexar County [Texas], and as much more between that and the coast." Shipped to the East, this gum was employed in the manufacture of both gumdrops and mucilage.

In a biological survey of Texas at the turn of the century a federal agent wrote that mesquite gum needed "only introduction to a market to become of commercial value." It had long been used in Mexico in the preparation of medicines; dissolved in water, the gum served as a gargle for sore throat. For the Pimas it had been a treatment for sore eyes and open wounds. In 1945 the Texas Forest Service of Agricultural and Mechanical College of Texas reported that one type of mesquite gum could be used as "a substitute for gum arabic, gum tragacanth, Indian gum, and ghatti gum, of which the United States imports 10,000,000 pounds annually. These gums are used in the manufacture of pharmaceuticals, confections, mucilage, textiles, and cigars."

Perhaps no part of the mesquite has served so well as its durable wood with a wide range of uses. Lipan and Apache Indians made bows of mesquite. In 1810 the Mexican leader Morelos fought the Spanish with a cannon constructed from a mesquite log. Early settlers in the Southwest made pickets of mesquite and used the wood for joists, rafters, studs, and floors in their cabins and mills. Mesquite wood was "equal to that of cedar for the purposes of fences" and formed a "principal and suitable article for fire-wood," writes Mary Austin Holley[3], whose book on Texas was published in 1836. Describing the resources of Texas in 1858, J. De Cordova[4] says that mesquite wood was "used to the exclusion of every other wood for making hubs and spokes, and is highly spoken of, by shipwrights, for making the ribs and knees of small vessels. In durability it exceeds almost any other wood in use."

The city of San Antonio used hexagon-shaped blocks of mesquite to pave a street in 1901. Such pavings are said to last a quarter of a century without serious deterioration. Although a survey in South Texas of the commercial possibilities of mesquite wood in 1916 showed that only 10 per cent of the wood examined was suitable for logging, recent research indicates that opportunities may lie in another direction. According to the report made by the Texas Forest Service: "It appears that chemical processes – in which the material may be used in bulk in the form of chips or wood fiber – hold the key to any industrial opportunities for utilization of great volumes of mesquite or brush."

Unfortunately utilization research thus far has not been adequate to determine what products could profitably be manufactured from woody fiber, which may be an excellent chemical raw material. Production of tannin for the hide and oil industries and fiber for paper and paperboard products may well prove to be feasible.

The singular story of the mesquite's extensive invasion of the treeless regions of the Southwest probably begins with its entrance from Mexico, where herds of horses and cattle were turned loose by Spanish explorers. These animals and the wildlife – buffalo, rodents, and birds – undoubtedly dispersed the mesquite's hard-cased seed far north of the Rio Grande. The vigorous seedlings found competition from native grasses, but these grasses were weakened first through burning by Indians and later through overpasturing by the white man.

Pioneers also burned accumulated grasses each year to protect their homes from accidental fires and, or so they thought, to improve pasturage for their horses and cattle. Although "burning over" probably did much to hold mesquite in check, it certainly ruined hundreds of acres of good sod and paved the way for rapid infestation as soon as the practice was discontinued.

By 1875 the buffalo had disappeared from the prairies, and the Indians had been removed from Texas by act of Congress. For almost a decade the grasslands were, in a sense, left unmolested. The years from 1874 to 1884, according to Jared G. Smith, an agrostologist for the Department of Agriculture in 1908, "may be

(*Continued on page 376*)

[1] William B. Parker, *Notes Taken during the Expedition Commanded by Captain R. B. Marcy through Unexplored Texas*, page 105 (Philadelphia: Hays and Zell, 1856).

[2] Parker, *opus cited*, page 170.

[3] *Texas*, page 17 (Lexington, Ky.: J. Clarke and Company, 1836).

[4] *Texas: Her Resources and Her Public Men*, page 273 (Philadelphia: E. Crozet, 1858).

The Great Dream — II

In the Continued Search for the Great Southland, Australia and Many Islands in the Pacific Ocean Were Discovered. But the Myth of the Fabulous Southland Was Exploded by Captain Cook in 1775

By WILLY LEY

At this point it is necessary to go back for a few decades and to discuss business. Just after these first big trips by da Gama for Portugal and by Columbus for Spain, the heads of both governments realized that their efforts at exploration, colonization, and long-distance commerce would lead to deadly rivalry. There would be clashes on far-off coasts; there would be disputing claims from both sides. There would be war between them, sooner or later. They had the choice of going to war with each other right then and there, or to attempt mediation before anything happened.

So both went to the pope, and the head of the Church was willing to settle these worldly matters, too. The pope, Alexander VI, Borgia, decided as follows: he drew a line around the globe, going from pole to pole, partitioning the earth into a Western and an Eastern Hemisphere. The Eastern Hemisphere enclosed the larger portion of Greenland; and of the Americas the eastern "bulge" of South America — roughly the Brazil of today. It included all of Europe, Africa, Arabia, India, and Asia except for its eastern tip. That hemisphere was handed over to the Portuguese, to colonize all land in it that did not already belong to somebody else; to trade with all the countries in it that would accept such trade. It might be better to say that the Spaniards were to keep out of that hemisphere, even though Spain itself was in it, of course. On the other hand, the Portuguese had no rights in the other hemisphere — all of North and most of South America, and everything east of Korea.

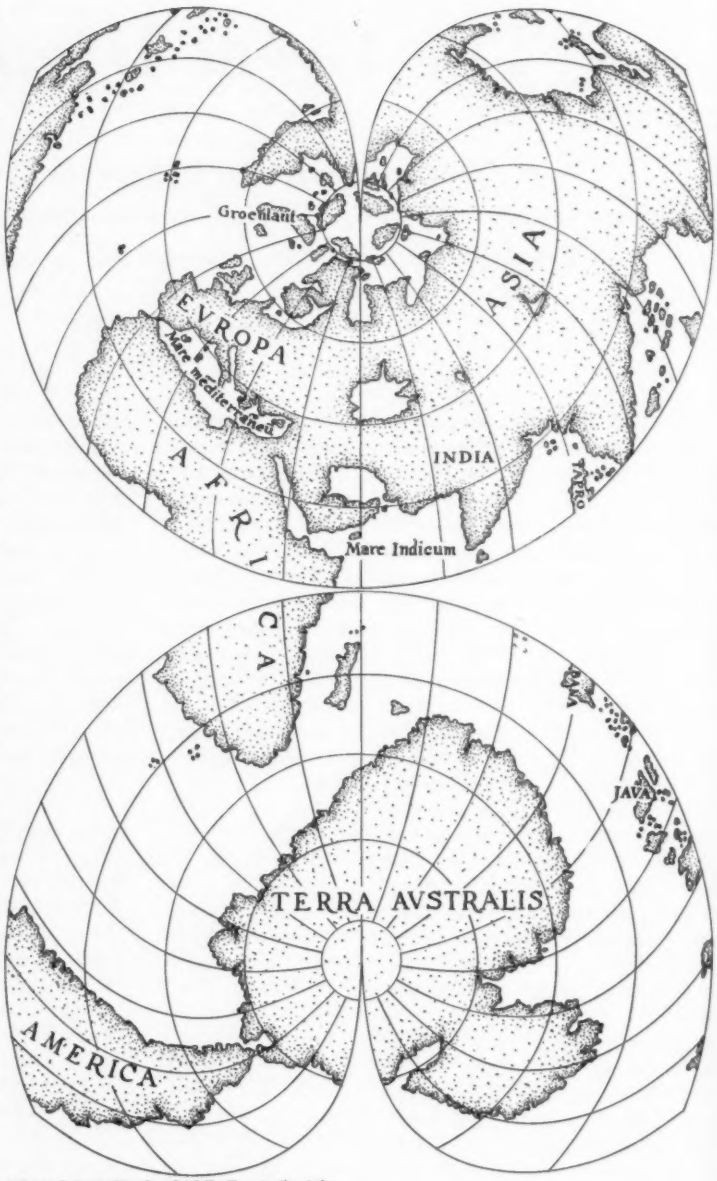
The agreement worked well, especially as far as the Americas were concerned where that line could be well determined. But when it came to the other half of the meridian, things became difficult. It is true that the Portuguese concentrated on the spice trade, while the Spaniards preferred gold. But the Spaniards would accept some spice trade too, and the prize, the Spice Islands, the Moluccas, were just on that line.

Saying that they were right on that dividing line means to express the most conciliatory point of view. Both Portugal and Spain were convinced that the Moluccas were on their side of the line. Each country had no trouble finding several recognized expert geographers ready to a man to swear any oath that the Moluccas really belonged to Spain, or to Portugal. Still it did not come to war between these countries, and after many impressive announcements of various

Adapted from Fite and Freeman's A Book of Old Maps

Western Hemisphere as reproduced in the globe of Johannes Schöner constructed in 1520. The Pacific and the Americas are considerably reduced in size and the Terra Incognita *of other cartographers becomes the* Brasilia Inferior *of Schöner. The presence of the large mass of southland on Schöner's globe stimulated Sixteenth-Century explorers to search for the mythical rich land.*

Map of the world prepared by Orontius Fineus in 1531 had, as a prominent feature, a huge continental area to which Fineus gave the name Terra Australis. *This beautiful map by Oronce Fine, to use another form of his name, influenced Mercator in the preparation of his more detailed map of the world, produced seven years later.*



Adapted from Nordenskiöld's Facsimile Atlas

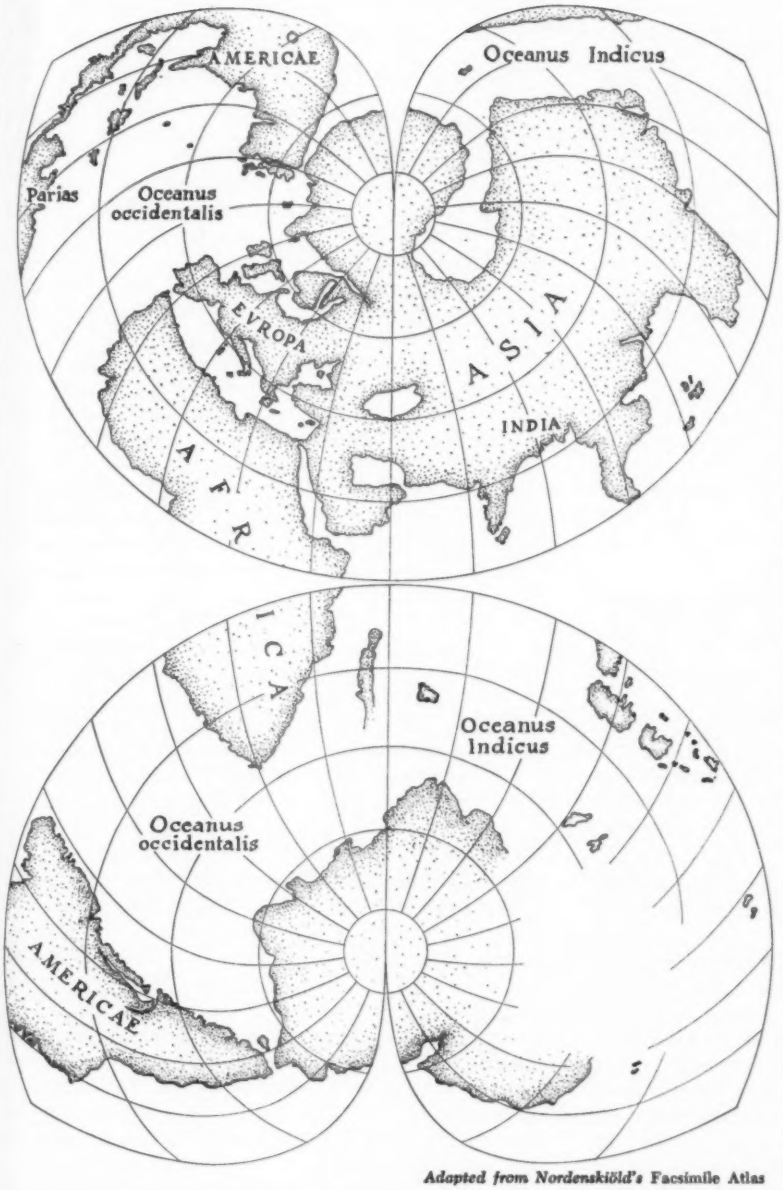
kinds, the two rivals made an amicable agreement. On April 22, 1529, the Crown of Portugal paid to the Crown of Spain 350,000 gold pieces for a temporary settlement. The Moluccas were to be regarded as being west of the papal meridian, so that they belonged to Portugal alone. In case a later improved geography should establish that they would have belonged to Portugal anyway, the Spanish Crown was to return the sum – hence "temporary agreement" pending the improvement of the science of geography.

The Portuguese were happier with the settlement than the Spaniards. Their spice trade flourished. But a sum of money, even 350,000 gold pieces, does not last endlessly. The Spaniards felt that they had lost something and began to look for more unknown land. *Terra Australis,* so neatly pictured on Schöner's globe, was a big temptation. It should be found . . . and Captain de Retes' report about his New Guinea Coast found eager listeners. Besides, it was not just that one geographer, Schöner, who drew the *Terra Australis:* Oronce Fine (Orontius Fineus) had produced a most beautiful map with *Terra Australis* in 1531. In fact, he was the inventor of that name. Before him, the *Terra Australis* had been called "Continent of the Antipodes," *Brasilia Inferior,* or, most of the time, simply *Terra Incognita,* "unknown land." And Oronce Fine had influenced another cartographer, a Flemish gentleman by the name of Gerhard Kremer. Now "Kremer" means "merchant," so naturally Gerhard Kremer, in due course of growing up, became known as Gerardus Mercator.

Mercator put Fine's *Terra Australis* on his map of the world of 1538 and, later, on his famous Chart of the World of 1569, the much admired masterpiece of map making for generations. It was the great authority which could not contain a mistake. If the great Gerardus Mercator showed *Terra Australis* on his chart, well, then, there was such a continent – and the inability of seamen to find it was simply plain inability on their part. And it is a wonderful map. Europe and Africa look just as they do on our maps. Asia is generally correct except that there are uncertainties about the coast line of the extreme northeast of Siberia; well, that was before Vitus Bering set out on his long trek across Russia and Siberia. Mercator guessed correctly at the existence of Bering Strait; it was one of the objectives of Bering's expedition to find out whether there was such a strait, or whether Siberia and Alaska were hanging together.

South America was drawn too wide in its southern parts, but the beautiful feature was *Terra Australis.* Tierra del Fuego was part of it. From there on, the coast line ran east at about the same degree of latitude, approaching Africa a bit more closely, then forming a big gulf just south of Ceylon to turn straight north immediately afterwards. *Terra Australis* almost touches Java, is separated by a narrow channel only from New Guinea, and then continues to join with Tierra del Fuego again.

The Mercator chart not only became standard in itself, but also influenced countless other maps of which the more famous ones are those of Tommaso Porcacchi, Joannes Myritius, Cornelis de Jonde, Ortelius, and Matthias Quadus. Quadus' map was dated 1608.



Adapted from Nordenskiöld's Facsimile Atlas

Although lacking the presumed geographical details of Terra Australis *which appear on the Fineus map of the world, the famous map of the world by Gerardus Mercator, of 1538, portrays Europe, Africa, and Asia quite well (except for northeast Siberia) and does a very creditable job of the Americas. This map influenced the work of other important cartographers of the Sixteenth Century.*

We return now from the strain of map making to the even more strenuous business of finding what the maps portrayed. As has been said, the Spaniards were especially interested after having sold the rights to the Moluccas. They were determined to find themselves more business elsewhere, and in 1567 the Viceroy of Peru sent General Mendaña with two ships to find *Terra Australis.*

Things had certainly changed since the time of the first exploratory trips from Portugal. Then *Terra Australis* was anticipated with some trepidation; if it existed it would block the way to East India, the goal of the journeys. Now *Terra Australis* was a goal in itself for colonization and commerce. The Spaniards were not only sure that it existed (Fine and the first Mercator map said so) but they also were certain that it was inhabited. Several priests were taken along to begin missionary work from the moment of landing.

Alvaro de Mendaña had been sent to "discover certain islands and a continent" in the South Seas. He failed as far as the continent was concerned. He might have made good on his orders by finding Australia, but he discovered "certain islands": the Solomons. Mendaña hesitated for a generation's life span to colonize the islands he had discovered. At long last he set out to do so, in 1595, having one Pedro Fernandes de Queirós as his chief pilot. Mendaña died while the expedition was on its way, and Queirós succeeded him in command. The result was that the islands were not found at all.

Queirós returned to Peru and thence to Spain. That he had failed to find Ophir (the Solomons) was just a minor misfortune and did not matter much. After all, there was still *Terra Australis* to be discovered. He went to the pope and told him how many millions of souls waited to be saved on *Terra Australis.* He went to the king of Spain and besieged him with countless petitions stressing the riches of the unfound lands. Finally, the king was either convinced or weakened and in 1603 a royal cedula was issued sending Queirós on his way to *Terra Australis* with three ships. The second in command was a navigator by the name of Luis Vaez de Torres.

After a journey which changed course about once a day for the purpose of avoiding real and imaginary storms, the expedition reached the New Hebrides (the name was given much later) and found a fair-sized island among them. It is often called Merena and is about as large as our smallest state. That, however, did not faze Señor Queirós. The *Terra Australis* was formally annexed to Spain, there was the laying of a cornerstone for a city of New Jerusalem, and the formal christening of a middle-sized rivulet as New Jordan. Three solemn masses were said, and Señor Queirós added a toast to the king. The island was christened *Austrialia del Espíritu Santo* — "Southern Land of the Holy Spirit." It is more than likely that there was even some punning in the name, taking advantage of the

Adapted from Fite and Freeman's A Book of Old Maps

Nautical chart of the world, of 1569, by Gerardus Mercator and employing the cylindrical projection named after Mercator. This type of projection found wide favor with navigators during the great period of exploration, since all points are shown at their correct compass courses from one another. Copyright notice, directions for measuring distances, and explanations of the method and purpose of the map cover portions of the original map. These pieces of text are omitted here, which explains why certain areas appear to be uncharted.

similarity between the words *Australis* (south) and the name of "Austria" which was then a fief of the Spanish king and emperor.

All this was followed by the interesting anticlimax that Señor Queirós decided to go home quickly, leaving Torres with two ships in the New Hebrides. Queirós presumably thought that everything had been accomplished save for the proper presentation of his feat, and he was the man to take care of that aspect. He sat down and wrote and wrote and wrote. During the period from 1607 to 1610 alone, he sent 50 long memorials and petitions to the Crown of Spain. He "was convinced" that *Espíritu Santo* was larger than all Europe, richer than Peru at the time of its discovery, more thickly populated than Cuba, and over its plains roamed enormous herds of wild cattle. That there are no native cattle in the whole Pacific region did not disturb him; but nobody believed him anyway.

Australia, the real Australia, was then still unknown, but it was seen very soon after for the first time just because of Queirós. His second in command, Torres, who should have been the expedition's leader, had waited for two weeks for the reappearance of Queirós' ship that had vanished in the dark of a stormy night. Then he decided to depart and report at the nearest Spanish stronghold, the Philippines. Doing that he sailed through a then unknown strait (it now bears his name) passing along the still unknown southern coast of New Guinea. To his left he saw what looked like distant islands; they were the mountains of Cape York, the northern tip of Australia.

Queirós' fabulous accounts were not believed, and Torres' straightforward report was not even forwarded from the Philippines. The British found it in the archives of Manila a century and a half later and saw to it that at least the strait through which Torres had sailed was named after him. The Queirós episode was annoying for everybody concerned, but it did not damage the reputation of *Terra Australis*. Things like that had happened before. People had claimed that they had traveled to America, and it had turned out to be a hoax. But that had not changed the fact that America existed.

However, the story of *Terra Australis* was then taken out of Spanish hands and passed on to another nation: the Dutch. The first connection of the Dutch with *Terra Australis* was damaging to the great Southland. One of the main reasons why it had been put on the map had been Magellan's statement that he had seen land to his left when passing south of South America: Tierra del Fuego. In 1616 Willem Corneliszoon Schouten and Jaakob Le Maire sailed around Tierra del Fuego in the south, discovering Cape Hoorn.* Schouten then knew that this was just a group of islands. He was uncertain about only one of them, the easternmost, called Staatenland. Staatenland's insular nature had not been definitely established. It might

* This is the spelling which should be used. The Cape was named after one of Le Maire's ships which in turn was named after the Dutch city of Hoorn. It became known later that Francis Drake had perfect knowledge of the insular nature of Tierra del Fuego some 38 years before Schouten and Le Maire.

still be a cape of *Terra Australis*. Hendrick Brouwer solved that problem in 1643; Staatenland was an island too.

At this point the real southern continent, Australia, slowly begins to seep into the story. Luis Vaez de Torres had seen it from a distance without realizing what it was. A French navigator, Guillaume le Testu, is reported to have seen it; a Portuguese captain also figures in the early history of Australia, and, of course, several Dutch captains, who, because of the Dutch possessions in the East Indies were, after all, nearby. It would be comparatively easy to evaluate their claims if people had not been biased in favor of *Terra Australis*. As it is, one can never be sure about these narratives. They may refer to the coast of the fifth continent, or they may have been colored by Mercator's wonderful chart.

From 1600 on, there exists a curious touchstone for the reports. In the course of time, *Terra Australis* had acquired all the attributes of a fairy-tale land; it had luxuriant tropical vegetation and beautiful inhabitants, gold was an ordinary metal, and diamonds and emeralds were reported as numerous as pebbles on the beach.

By contrast the real Australia was an immense disappointment. The vegetation was not tropical, the coast was generally uninviting and completely devoid of gems. The aborigines, if encountered, were not at all beautiful; in short, all those who were disappointed with the coast they attained – all those who gave vent to that disappointment by disparaging remarks – were the men who had really set foot on Australia.

By 1642 Australia's West Coast was generally known to the Dutch under the name of New Holland. In that year the governor of the Dutch East Indies, Anton van Diemen, ordered Abel Janszoon Tasman to sail from Batavia and establish the truth about *Terra Australis*, especially with reference to the New Holland Coast.

Tasman left, sailing a course which was carefully calculated either to bring him to the coast of *Terra Australis* or else to lead around New Holland to whatever open seas there were on the other side. After a long journey he reached what was unmistakably a southern cape, a southern ending of a continent, like Cape Agulhas in Africa. Tasman thought that it was the southern end of what we now call Australia, and in honor of his governor he called it Van Diemen's Land. Actually, it was not even Australia proper anymore; it was the southern end of the large island now known, in his honor, as Tasmania.

Going on for another thousand miles he saw land again, looking with amazement at the snow-covered high mountains of the "Alps" of the South Island of New Zealand. Then he turned north, sailed through the Tasman Sea between Australia and New Zealand, and returned to the Dutch Indies.

Australia had been rounded, but even Tasman did not dare to delete *Terra Australis* from the map. He had seen land with high mountains; it might stretch all the way to Staatenland near Tierra del Fuego. While Tasman was writing this, Brouwer sailed around Staatenland, but it did not matter because what Tasman himself had seen was certainly more than a small island.

During the first decades of the Eighteenth Century scientific reasoning began to follow another path. Slowly it became clear that *Terra Australis*, if it existed at all, was an Antarctic Continent. All the coasts still unidentified as islands, all the coasts still under suspicion of being outposts of *Terra Australis*, had ac-

Adapted from Nordenskiöld's Facsimile Atlas

Based on Mercator's projection, this map of 1608 was produced in Köln (Cologne) by Matthias Quadus. The map is inferior to that by Mercator 39 years earlier in not containing longitude and latitude lines. Mercator's map of 1569 placed the zero longitude about 20 degrees east of Greenwich, now reckoned as the reference longitude.

quired the same characteristic: these coasts were no longer under the green cover of tropical vegetation in warm waters, blending with the sky and the sea and distance, they all shone clearly and brightly with the reflection of snow on high mountains.

A report from a French vessel under the command of Lozier Bouvet enhanced that impression. Being some 800 miles south of Cape Town and a little west of it, Bouvet had found a coast from which a huge glacier seemed to flow into the sea. The weather had been bad, the visibility poor, and Bouvet had not been able to see much, but he was certain that it was not an iceberg but land, and he called it *Cap de la Circoncision*. The term "cape" was used, of course, with reference to *Terra Australis*. It had always been suspected that there was much open sea between Africa and the Southland. Bouvet had now determined just how much open sea: over 800 miles.

The extremely bad weather conditions in that zone – dense fog or rain almost all year round – rendered Bouvet's "cape" a major puzzle of geographical science for the whole interval between 1739, the year of discovery, and 1899 when it was finally found by the oceanographic-survey steamer *Valdivia*. Long before that, it had become clear that Bouvet had not discovered a cape of a continent; the question was merely whether there actually was a small island somewhere down there, or whether he had been fooled by a large iceberg in spite of his assertion. It turned out to be a small island, which was actually just one large extinct volcano, completely glaciated. It can now be found as Bouvet Island on any map; politically, it is Norway's.

Before Lozier Bouvet's report had even arrived in his homeland, the most versatile and generally greatest French naturalist of that period, Count Georges Louis Leclerc de Buffon, had formed a new opinion of *Terra Australis*. What he said seems to have been just an expression of the general feeling at that time.

Terra Australis was still not abandoned, but Buffon did not doubt that this large continent was in the main an Antarctic Continent. Not completely so, but the bulk had to be sought beyond the Antarctic Circle. It was, Buffon wrote, a sixth continent, not directly connected with any one of the known five. It might still be the largest – as big as Asia, Africa, and Europe taken together. That the Antarctic should be colder than the Arctic, Buffon continued, was merely a wrong conclusion, formed because of the observed and presumably correct fact that Antarctic icebergs were larger than those of the Arctic, and that they, therefore, could drift farther toward the equator before melting.

But these large icebergs meant something different to Buffon. They indicated enormous rivers which could exist only on a large continent. They also indicated long chains of high mountains where the moisture to feed those rivers could condense.

One more thing could be suspected from that evidence. Look at South America. It had been reached from the Atlantic, and consequently the low-lying sections had become known first. They were inhabited by primitive races with no culture and no capacity for abstract thought, no organization, and poor technology. But when the white race penetrated to the highlands, Peru, they found a highly developed system of political rule, a well-developed religion, high culture, and comparatively high technology.

The aborigines of Australia could be compared to the natives of the South American lowlands. What would be more logical than to assume that *Terra Australis*, with its high mountains, had developed a similar high culture like the highlands of South America? It was a fascinating idea, and it is almost regrettable that Buffon had guessed wrong. His ideas were the last attempt to maintain something of the magic of *Terra Australis* which had lasted throughout so many centuries of the past.

While the book containing this last important Southland philosophy was still avidly read in France, an English shipmaster, who had worked his way up from common seaman in the British Navy, was surveying the coasts of Newfoundland and Labrador. His splendid work attracted favorable attention, and when it became necessary to send a ship to the South Seas, he was selected to be its captain.

The name of the vessel was *Endeavour*, and the name of the captain was Cook, James Cook. Admiring contemporaries, and even more so the later generations so much regarded him as the epitome of the great sailor, that his first name can be found only in encyclopedias nowadays. He was not James Cook, a captain in the British Navy, he was Captain Cook.

Captain Cook first sailed to Tahiti since the primary objective of the trip was the observation of a Venus transit across the disk of the sun, and Tahiti was the place to do it. That accomplished, Cook set out to solve the problem of *Terra Australis*, and the point where he began was that mountainous coast east of Australia which Tasman had seen. It was the only definite thing anybody knew about Southland. Cook began there. On October 6, 1769, land was sighted. If it was the same that Tasman had seen, it would have to be a long northern promontory of *Terra Australis*, because Cook was approaching from the other side. The thing to do was to try and sail around it; that would solve the question of whether it was a promontory or an island. A few months later the land had been rounded; it was the North Island of New Zealand.

There was another land south of that large island. Was it a promontory or another island? By the end of March, 1770, that question had been disposed of too; the land first seen by Tasman was the South Island of New Zealand, and south of the South Island there was nothing but open sea – the same thing that Tasman had had to report about his Van Diemen's Land.

Captain Cook then returned through the Torres Strait, clearing up that old semimystery which had been a leftover from the Queirós expedition to Land of the Holy Spirit and went home. But now although, or rather because of the fact that he himself had destroyed the last reliable looking evidence for *Terra Australis*, he was really interested in the problem. The year 1772 found him on the high seas again; this time with two vessels, the *Adventure* and the *Resolution*, and for the avowed purpose of either finding or destroying the old *Terra Australis*. In the process of this journey he discovered New Caledonia, but that was after his first stab at *Terra Australis* had failed. He had one more spot on his map where the great South-

(*Concluded on page 374*)

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

Industrial Management Dean

EDWARD PENNELL BROOKS, '17, Vice-president and Director of Sears, Roebuck and Company, has been chosen to head the new School of Industrial Management at the Institute. The appointment of the Chicago industrial executive as dean of the school, which is to be established with the $5,250,000 gift of the Alfred P. Sloan Foundation, Inc., was announced by James R. Killian, Jr., '26, President of M.I.T., to members of the M.I.T. Club of Chicago at its annual meeting on April 5. Mr. Brooks goes to his post in September, and the school, which is expected to give a new dimension to management as an academic field, will open by the fall of 1952.

The appointment followed an intensive study of the qualifications of a number of leading industrial executives. The choice of Mr. Brooks to head the new school, Dr. Killian said, was based on his comprehensive industrial experience and his knowledge of the engineering implications of management.

In announcing Mr. Brooks's appointment, Dr. Killian outlined plans for the school which have been under consideration for some time:

> The program represents, we believe, the most advanced concept of education and research on the problems of administration in technical industry. Our objective is to capitalize on the broad resources of science and engineering at M.I.T. by correlating them with the complex problems of industrial administration. If this is well done, we can hope to contribute in the most effective way, through instruction and research, to a broader status and higher scientific level of industrial management. This program calls for recognition that modern management has achieved the status of a science, and it calls for imagination and bold exploration based on the highest professional standards of teaching and research.
>
> In Mr. Brooks we have found a happy combination of those qualities which we believe to be so important for organizing and administering the school. He not only has a thorough knowledge of modern industrial management and manufacturing procedures, but what is equally important, a basic understanding of the relationships of human beings within an organization, as well as the relationships and mutual obligations of business and society.

Mr. Brooks is the son of Bertha P. and the late Harry D. Brooks. He was born in Westbrook, Maine, on July 11, 1895, from a family whose ancestors had lived in Maine for many generations as manufacturers, farmers, and merchants. After graduating from the Westbrook High School he entered M.I.T. and was graduated in the Class of 1917. He served in World War I as a first lieutenant in the First Engineers of the First Division, American Expeditionary Force, 1917 to 1919, and was awarded the Distinguished Service Cross. Following his war service he studied at the Sorbonne in Paris and, upon his return to this country, took advanced work at the New School for Social Research in New York. In World War II, he organized and was chairman of the Committee on Equipment and Materials on the Research and Development Board of the United States Military Establishment. He also served as vice-deputy in charge of the War Production Board Mission which visited China in 1945. He has been awarded the Medal of Freedom as well as the Chinese Victory Medal.

Mr. Brooks's early business experience was gained with the American Cotton Oil Company, the Barrett Company, and Montgomery Ward Company. With the exception of the year 1933-1934, when he was assistant to the vice-president of the United States Steel Corporation, Mr. Brooks has been associated with Sears, Roebuck and Company since 1927. During those years he served as retail merchandise manager, district manager, supervisor of the mechandise department, general factory manager, and he has been vice-president in charge of factories since 1939. He was elected a director of the company in 1941. In addition, he is a director of the Erie Railroad Company, the Chicago Corporation, the Florence Stove Company, the Seeger Refrigerator Company, Globe Union, Inc., Birtman Electric Company, and the Whirlpool Corporation.

Fabian Bachrach

Edward Pennell Brooks, '17,

Vice-president and Director of Sears, Roebuck and Company, Chicago, who has been appointed dean of the new School of Industrial Management to be established at M.I.T.

Mr. Brooks served as a term member of the Corporation of the Institute from 1940-1945. He has also served as a director of the Chicago Community Fund since 1941, and as a director of the Chicago Chapter of the American Red Cross since 1942.

The curriculum of the school will emphasize industrial management, including not only the technical aspects of business problems, but the broad field of human relationships. The program will embrace both undergraduate and graduate instruction, with an active research program co-ordinated with the curriculum. Problems of industrial management, as distinct from finance and other types of business activity, will be stressed.

Referring to Course XV, Dr. Killian said: "Our Department of Business and Engineering Administration and its flourishing courses will, of course, become an important part of the new program, and its activities will be extended in scope with a view to developing a self-contained unit concentrating on the specific problems of industrial management."

Draper to Head Course XVI

THE appointment of Professor Charles S. Draper, '26, as Head of the Department of Aeronautical Engineering at M.I.T., was announced by President Killian on April 3. Dr. Draper, whose appointment becomes effective on July 1, will succeed Professor Jerome C. Hunsaker, '12, who in 1914 founded at M.I.T. the first professional Course in Aeronautical Engineering in this country. He has been its head for many years and is internationally known as a pioneer in aeronautical-engineering education. Dr. Hunsaker, who asked to be relieved of administrative responsibility for the Department, will continue as a professor until his retirement next year.

Fabian Bachrach

Professor Charles S. Draper, '26,

who has been appointed head of the Department of Aeronautical Engineering at M.I.T.

Dr. Draper, Professor of Aeronautical Engineering, has been deputy head of the Department as well as director of the Instrumentation Laboratory, which he will continue to administer for the time being.

The Department of Aeronautical Engineering at M.I.T. grew from the graduate course established by Dr. Hunsaker, who was graduated from the United States Naval Academy in 1908 and also holds the degrees of master of science and doctor of science from M.I.T. Dr. Hunsaker spent the summer of 1913 in England on the staff of the wind-tunnel research group of the National Physical Laboratory at Teddington, and from there he went to Paris to assist Gustave Eiffel in wind-tunnel studies of model airplanes.

Upon his return to this country in 1914, he was granted leave from the Navy to come to M.I.T. to establish the Course in Aeronautical Engineering. In 1916 Dr. Hunsaker was recalled to duty in the Navy. The new course, by that time well established, continued to grow through the years. In 1933 Dr. Hunsaker returned to the Institute to become head of the Department of Aeronautical Engineering, and he also served for a time as head of the Mechanical Engineering Department.

Dr. Draper is a member of the Scientific Advisory Board of the Air Force and a panel member of the Research and Development Board of the National Military Establishment. Over the past 22 years he has made notable contributions in teaching and research at the Institute. He has had wide experience in the fields of aeronautical power plants, flight testing, vibration measurements, aeronautical instruments, and control engineering, with special attention to applications of gyroscopic principles for military and commercial equipment. During the past 10 years, his research has been principally concerned with antiaircraft fire control for the United States Navy and airborne fire control equipment for the Air Force. At the present time, developments made under Professor Draper's supervision are in wide use by both the Air Force and the Navy.

Dr. Draper is responsible for an extended curriculum of courses in the fields of instrument engineering and fire control. These courses include not only regular instruction by the Instrument Section of the Aeronautical Engineering Department but also classified work leading to degrees for Navy and Air Force officers in armament and fire control.

Dr. Draper was born in Windsor, Mo., on October 2, 1901. He is the son of Dr. and Mrs. Charles A. Draper, and started his education in the primary and high schools of Windsor. His college work began in arts and sciences at the University of Missouri in 1917. In 1919 he entered Stanford University and was graduated in June, 1922, with the bachelor of arts degree in psychology. He entered M.I.T. in the fall of 1922 and has been continuously associated with the Institute since that time. He has three degrees from the Institute. They are bachelor of science in Electrochemical Engineering awarded in 1926, master of science in 1928, and doctor of science in physics in 1938.

Dr. Draper has written numerous articles in the fields of instrumentation and control, and has served as consulting engineer to many aeronautical companies and instrument manufacturers.

He is a fellow of the American Physical Society, the Institute of Aeronautical Sciences, and the American Academy of Arts and Sciences. He is a member of the American Institute of Consulting Engineers, and the American Society of Mechanical Engineers, Society of Automotive Engineers, Army Ordnance Association, Sigma Xi, Tau Beta Pi, American Association for the Advancement of Science, American Society for Engineering Education, and the New York Academy of Sciences. His fraternity is Sigma Alpha Epsilon.

In 1946 Dr. Draper received the Medal for Merit and the Naval Ordnance Development Award for his work in the field of antiaircraft fire control. Also in 1946 he was given the Sylvanus Albert Reed Award of the Institute of the Aeronautical Sciences for "Application of the Gyroscope to Computing Devices for Gunnery and to Other Computing Devices." In 1947 the Engineering Societies of New England granted him the New England Award for outstanding contributions to engineering.

Menninger Gives Memorial Lecture

GENERAL Secretary of the Menninger Foundation of Topeka, Kansas, and internationally known psychiatrist, Dr. William C. Menninger will deliver the fifth annual Arthur Dehon Little Memorial Lecture at the Institute on May 1. For this distinguished lecture, Dr. Menninger will speak on "Social Change and Scientific Progress."

During World War II, Dr. Menninger was a neuropsychiatric consultant and became director of the Consultants' Division in his field of medicine in the Surgeon General's Office, with the rank of brigadier general. It was during this period of his service with the Army that Dr. Menninger began to exert the kind of progressive and enlightened leadership which has brought him national and international prominence.

President of the American Psychiatric Association in 1948-1949, Dr. Menninger has been one of the leading exponents of the idea that psychiatry should come out of the hospital and contribute whatever it can to the general well-being of mankind.

Nuclear Engineering Strengthened

THE appointment of Manson Benedict, '32, as professor of chemical engineering at M.I.T. was announced the latter part of March by Thomas K. Sherwood, '24, Dean of Engineering at the Institute. Dr. Benedict, who comes to M.I.T. to expand and strengthen the educational program in nuclear engineering, will join the staff on July 1. In proclaiming Dr. Benedict's appointment, Dean Sherwood said:

During the past several years the Institute has expanded and strengthened its research and educational programs in nuclear engineering and related fields. Basic research in nuclear science is now a very large program, and the engineering studies being carried on for the Atomic Energy Commission include important work in heat transfer, metallurgy, mineral engineering, water treatment, blast-resistant buildings, and radiation shielding. Undergraduate and graduate subjects of instruction are offered in these and related engineering fields, and the M.I.T. Engineering Practice School at Oak Ridge, Tenn., offers the graduate student a unique engineering experience at the plants of the Atomic Energy Commission operated by Carbide and Carbon Chemicals Corporation at Oak Ridge. With the appointment of Dr. Benedict, the Institute plans to organize a formal program of education in nuclear engineering, initially at the graduate level.

Dr. Benedict received his bachelor's degree in chemistry from Cornell University in 1928, a master's degree from the Institute in 1932, and the degree of doctor of philosophy in physical chemistry from M.I.T. in 1935. From 1938 to 1942 he worked with the M. W. Kellogg Company and developed a widely used equation of state for hydrocarbon mixtures. From 1942 to 1946 he was associated with Kellex Corporation and was in charge of the process design of the gaseous diffusion plant for the concentration of Uranium 235 which was built for the Manhattan Project at Oak Ridge.

Prior to his return to the Institute, Dr. Benedict was director of process development for Hydrocarbon Research Inc. He is a member of the Atomic Energy and Research Committees of the American Institute of Chemical Engineers; and a member of a visiting committee of Brookhaven National Laboratory.

Dr. Benedict is the author of numerous scientific papers on hydrocarbon thermodynamics, separation processes, and physicochemical measurements. He received the Walker Award of the American Institute of Chemical Engineers for his publications on extractive and azeotropic distillation.

Professor Manson Benedict, '32,
who becomes a member of the Department of Chemical Engineering at M.I.T. on July 1.

Alumni Day, 1951

TECHNOLOGY Alumni will return to Cambridge on Monday, June 11, for their annual Alumni Day activities on the M.I.T. campus. The morning will be given over to registration and to reunions scheduled by 13 Courses in various Departments of the Institute. Courses holding reunions are: Aeronautical Engineering, Architecture and Planning, Biology, Building Engineering and Construction, Business and Engineering Administration, Chemical Engineering, Civil and Sanitary Engineering, Electrical Engineering, Food Technology, General Engineering and General Science, Mechanical Engineering, Metallurgy, and Physics.

Opportunity will also be provided to visit Institute buildings; for example, the new Hydrodynamics Laboratory and Ship Model Towing Tank, on Vassar Street, will be open for inspection, as will be also the new 12-M.E.V. Van de Graaff generator. Visitors will be able to see progress in the construction of the new Sloan Metal Processing Laboratory, at the corner of Massachusetts Avenue and Vassar Street, and the John Thompson Dorrance Laboratory of Food Technology and Biology, now rapidly rising on the campus at the rear of Building 8.

Plans call for the customary buffet luncheon at 12:30 P.M. in the Great Court, to be followed by an address, "State of the Institute," to be delivered by President Killian. John A. Lunn, '17, President of the Alumni Association, will also speak. At 4:00 P.M. Alumni and guests will have opportunity to meet President and Mrs. Killian in a social hour at the President's House.

The evening will be devoted to the popular Stein-on-the-Table Banquet at the Copley Plaza in Boston, where Richard M. Bissell, Jr., Deputy Administrator of the Economic Co-operation Administration, and Professor of Economics at M.I.T., will be the speaker of the evening. Those attending the banquet will also receive one of the popular steins designed by Henry B. Kane, '24. A special program is being planned for the ladies.

FM Station for Boston Colleges

PLANS for a new frequency-modulated radio station for educational broadcasting that will bring the cultural resources of six Greater Boston colleges, as well as the full concerts of the Boston Symphony Orchestra, to millions of New Englanders, were announced on April 3 by Ralph Lowell, trustee of the Lowell Institute, and member of the M.I.T. Corporation. The Lowell Institute has applied to the Federal Communications Commission for a construction permit to erect a high-power noncommercial educational station with 20,000 watts effective radiated power to be operated in the frequency-modulated band.

Beginning with its 71st season next fall, the Boston Symphony Orchestra will join the six Greater Boston colleges and universities who are now members of the Lowell Institute Cooperative Broadcasting Council, to inaugurate the new station, which will feature "live" full-length concerts of the orchestra broadcast direct from Symphony Hall. Thus, the membership of the orchestra in the Council will make it possible to add symphony music to the educational resources already provided by the co-operation of scholars and scientists at Boston College, Boston University, Harvard University, M.I.T., Northeastern University, and Tufts College.

Engineering plans for the new station have been prepared by representatives of M.I.T. and Harvard University. The station will be equipped with a three-kilowatt frequency-modulated transmitter presented by Professor Edwin H. Armstrong of Columbia University, renowned for his contributions to electronic circuitry including the vital new concept in radio broadcasting popularly known as "FM." The proposed new station would be managed by Parker Wheatley who has been director of the Lowell Institute Cooperative Broadcasting Council since it was organized in 1946. As a major, he was chief of the Radio Programs Section of the Armed Forces Radio Service during World War II.

Commenting on the proposed station, Mr. Lowell said: "I believe few other communities can match the educational resources we have in this region. We shall, nevertheless, plan to bring to listeners outstanding educational programs of colleges and universities elsewhere in the country from the transcription network of the National Association of Educational Broadcasters."

Mr. Lowell, who was recently elected president of the Boston Museum of Fine Arts, is president of the Boston Safe Deposit and Trust Company, formerly an overseer of Harvard University, a member of the Corporation of M.I.T. and of Northeastern University, and a trustee of Boston University. He also is a fellow of the American Academy of Arts and Sciences. He holds the honorary degrees of doctor of laws from Northeastern University and of doctor of humane letters from Tufts College.

From the Council

ROSCOE H. SMITH, '23, formerly President of the M.I.T. Association of Cleveland, was introduced as the guest of honor at the 281st meeting of the Alumni Council on March 26, at the Campus Room in the Graduate House. John A. Lunn, '17, President of the Alumni Association, presided at this interesting meeting, attended by 101 members of the Alumni Council, at which President Killian and Professor Bernard E. Proctor, '23, Acting Head of the Department of Food Technology, were the evening's speakers.

The business portion of the meeting was held to a minimum as Donald P. Severance, '38, Alumni Secretary, reported that the cost of the midwinter alumni meeting held on February 1 had been kept within the budgeted figure of $700; in spite of rising costs, the prices for the luncheon and banquet tickets for Alumni Day would be the same as last year; and a budget of $2,500 had been established for the operations of Alumni Day, 1951. Between February 24 and March 15, Raymond Stevens, '17, and H. E. Lobdell, '17, Executive Vice-president of the Alumni Association, visited five alumni clubs in Puerto Rico and the Midwest. Also reported was the vote of the Executive Committee to recognize the newly formed M.I.T.

(Continued on page 364)

BUSINESS IN MOTION

To our Colleagues in American Business . . .

Never has industry turned out more goods than during the past few years of unprecedented customer demands. In endeavoring to meet these, Revere has developed new techniques, established new plants, installed the newest equipment and modernized the old, and stepped up its training program, including the development of some new ideas in relation to safety. Throughout the country, similar steps have been taken by manufacturers generally. This is the response of free enterprise to the stimulus of a free and growing market. It is fortunate that American industry was not only willing but able to do this, because now it is evident that these facilities and these skills must be devoted more and more to the defense of our freedom.

Defense Orders or "DO's" are being issued, and their volume is bound to increase. Already prime contractors are seeking sub-contractors, and sub-sub-contractors are receiving orders too, down to small local firms operating only a few machines. Perhaps few people realize the importance of the "small shop"; the fact is that these establishments have a tremendous total capacity supplementing that of the great corporations, which practically never make everything that is needed for a finished product such as a tank, a plane, a ship, radar equipment. The "smalls" are just as vital as the "bigs."

Revere knows that when the time of trial comes, it is more important than ever to increase production efficiency. This makes complete information essential to those who have taken on DO contracts. Revere pledges its full cooperation, and will gladly provide all it knows about its metals.

This knowledge is made available in two principal ways. First, there are many booklets containing technical data, including physical properties, and also in many cases suggestions as to recommended fabrication practices. In addition to the booklets, which are distributed on request, Revere either reproduces or summarizes them in the various Sweet's Files, Chemical Engineering Catalogue, Marine Catalogue, Refinery Catalogue. This printed material is therefore available freely to all who will ask for it, or look it up. The second way in which Revere's knowledge and skill is made available is through the Technical Advisory Service, a group of capable men whose collective experience covers practically all applications of copper and copper alloys, and aluminum alloys. In war and peace, these men have rendered invaluable service, collaborating closely on such matters as selection of the proper metal, temper, width, gauge, and in helping to solve production problems. As a result, scrap has been reduced, rejects lessened, production increased, money and materials saved. The services of the Technical Advisors are obtainable through the Revere Sales Staff which also has wide experience in the selection and application of Revere Metals. If you have orders whose specifications include non-ferrous metals, Revere will gladly place its information at your disposal.

If you purchase and work with other materials, Revere suggests that it should be realized that not only is American productive capacity tremendously greater, but that there has been a likewise large growth in knowledge about materials of all kinds. So it is recommended that no matter what you make now, or are called on to make in the future, you ask your suppliers to share their knowledge with you. It will make you and our country stronger.

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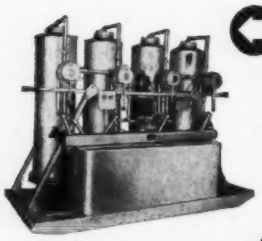

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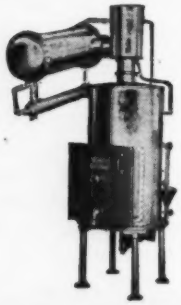

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THE INSTITUTE GAZETTE

(*Continued from page 362*)

Club of Belgium, whose organization meeting took place on January 13, 1951.

In commenting on recent activities of the M.I.T. Administration, President Killian outlined some of the background of the Institute's use of the estate at Round Hill, recalling early research on fog dispersal, aeronautics, and development of the high-voltage Van de Graaff generator which had been carried out with the interest and support of the late Colonel Edward H. R. Green. Almost three years ago, the Green estate near New Bedford, Mass., was permanently turned over to M.I.T. for research purposes, and President Killian announced that a recent bequest of the late Mrs. Matthew Astor Wilks would assure the maintenance and further expansion of this property which has numerous interesting potential possibilities for research and secluded study by members of the M.I.T. staff.

President Killian also recalled the high points of his experience of the past year as a member of the Communications Policy Board, to which he was appointed by President Truman. Charged with the "broader problem of developing a total national communication policy" the Board looked into such matters as allocation of frequencies for radio services; the dual responsibility of Congress and the Federal Communications Commission for the proper administration of nongovernmental radio communications, and of the President for the administration of governmental radio communication systems; the extent to which the government operates its own communication systems; the merging of cable communication systems; the peculiar problems raised by "record" and "voice" communication systems; and the desirability of establishing a temporary committee to anticipate this country's needs prior to international conferences or communications and frequency allocations.

Next introduced by President Lunn was Professor Proctor who spoke on applications of cathode rays in the food and pharmaceutical industries. Pointing out that electronics is opening new horizons for food and drug processing, he discussed the relative merits of sterilization by heat, x-rays, and cathode rays. Sterilization by cathode rays – electron beams – has the advantages of producing no appreciable temperature rise, of producing complete sterilization in a matter of a few seconds, and of lending itself to continuous processing methods. The possibility of using cathode rays for killing insect infestation, as grain is put into storage, promises to have important economic advantage. In applying cathode-ray sterilization, the flavor, or color of the product, may be altered in certain cases, and these problems are currently being investigated. Also under study is the depth of penetration for which sterilization by cathode rays is effective. Present indications are that generators of between 10,000,000 and 15,000,000 electron volts should be ample for sterilizing any or all types of canned goods ordinarily used in homes.

(*Continued on page 366*)

Scientists Solve Another Secret of Transformer Life-Span

Transformer failure is costly—far more than the cost of a new unit. So Westinghouse is constantly seeking ways to lengthen transformer life.

Of three major causes of transformer failure, two are well under control, namely, "burn-outs" resulting from "electrical overloads", and "lightning strokes". Now, a new painting system developed by Westinghouse engineers should go a long way toward solving the third problem—the problem of corrosion.

Transformers take a terrific beating from the weather. Boiling sun. Driving rain. Sleet. Snow. Salt-water spray along sea coasts. Acid and alkali exposure . . . all these conditions cut life expectancy sharply.

With the same determined effort that licked "electrical overload" and "lightning stroke" problems, Westinghouse scientists took up the fight against corrosion . . . came up with a three-deck "paint sandwich" that doubles transformer tank life—even where corrosion conditions are most severe.

Key to this improved finish is a middle layer of paint containing mica flakes in a syrup-like plastic that forms a coating like a shingle roof. First, a special primer is applied that seals the steel from the air. Then the insulating, weather-resisting coat is applied. Over that, a pleasing finish that shuts out ultraviolet light completes the job.

The illustration of the transformer tank at the left shows the effectiveness of the new finish. After 1000 hours of continuous exposure to corrosive salt-water spray, it is still bright and shiny, while the tank at the right, coated with standard finish, fell victim to the salt-water attack. The new finish is expected to provide the same results when exposed under all climatic conditions including sub-zero cold, desert heat and harmful sun rays.

Problems like this are just as important in research at Westinghouse as those which probe the depths of unchartered areas, because our concept of research is not only confined to a quest for the new, but includes an everlasting interest in improving the old as well. Westinghouse Electric Corporation, Pittsburgh, Pennsylvania. G-10130

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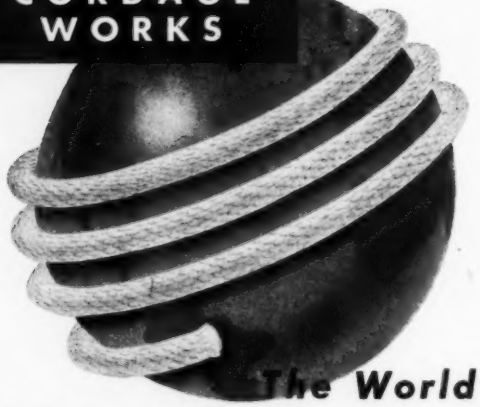

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THE INSTITUTE GAZETTE

(*Continued from page 364*)

Radiation Series Completed

THE Radiation Laboratory Series, 27 volumes containing the vast results of five years of intensive work on radar done at the Radiation Laboratory at M.I.T. during World War II, has been completed.

This monumental technical series was started in 1947 under the sponsorship of the United States Office of Scientific Research and Development, and was published by the McGraw-Hill Book Company under contract with the Institute.

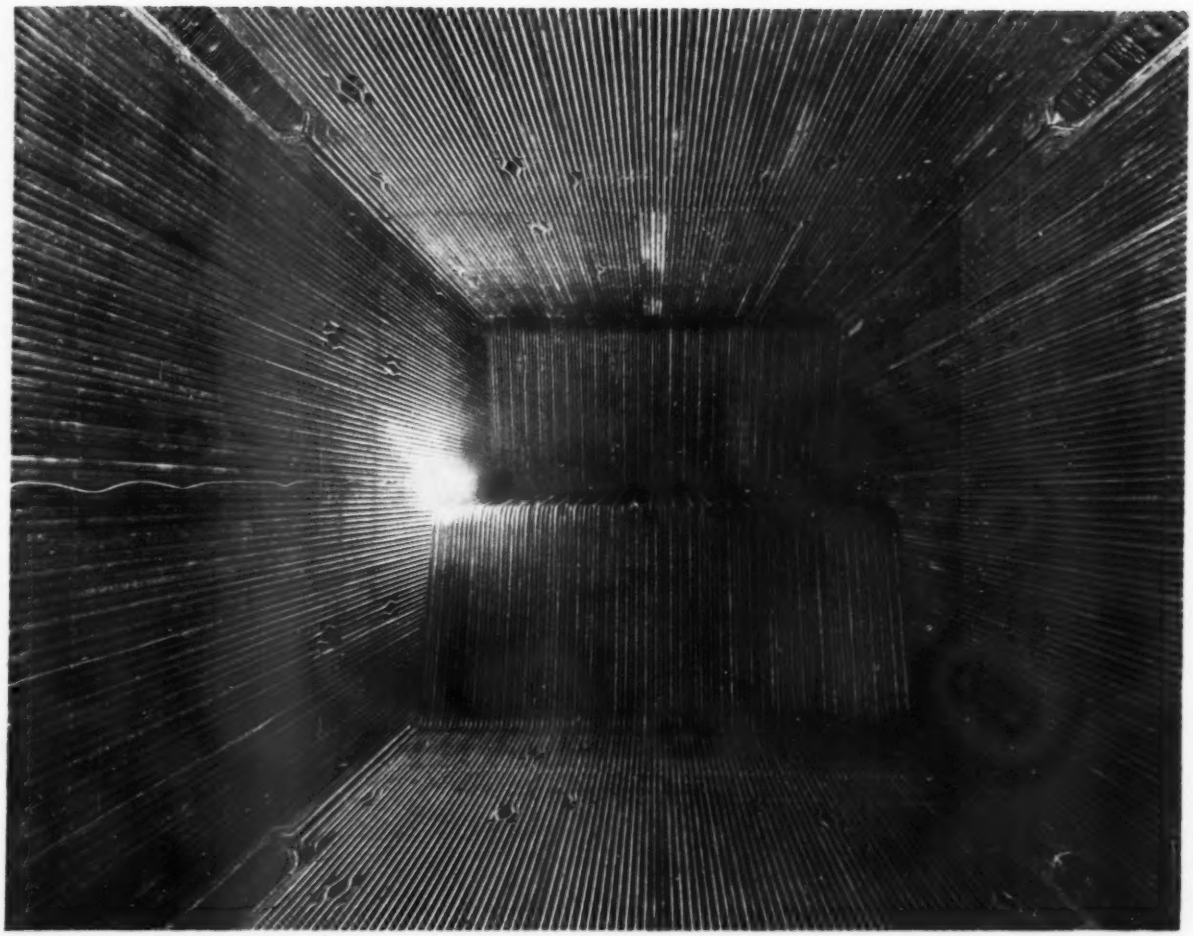
This is one of the rare cases in which a program of research has produced a complete report, which in this instance consists of basic information on microwave radar and modern electronics.

Land for Fraternity Housing

INSTITUTE land should be made available by lease to fraternities if this can be done without interfering with the Institute's long-range plans for developing its housing and recreational facilities, the Corporation Committee on Fraternity Housing recommended in its recent report to the Corporation.

In making its study of housing facilities, the committee took into consideration the desirability of giving students an opportunity to live in close proximity to the Institute, and the policy of restricting the prop-

(*Continued on page 368*)



Cathedral of Flame

You're looking up inside the furnace of a large power boiler, soon to be lighted off. Suppose you could stay . . . watch . . . and listen. You'd hear a roar as streams of fuel and air from the burners in the four corners rush together to form a whirling inferno. You'd see masses of flame, at temperatures as high as 3000 degrees F., spiraling upward toward the roof tubes six stories above. You'd learn, if you inquired, that a ton of coal, ground to flour fineness, was being consumed every two minutes.

And what's happening inside the tubes that line this furnace? Water races upward . . . evaporating into steam at a pressure of more than 1500 pounds per square inch. Then, superheated to a temperature of 1000 degrees F., steam leaves the boiler at hurricane speed on its way to the turbine-generator, where its energy is converted into electricity.

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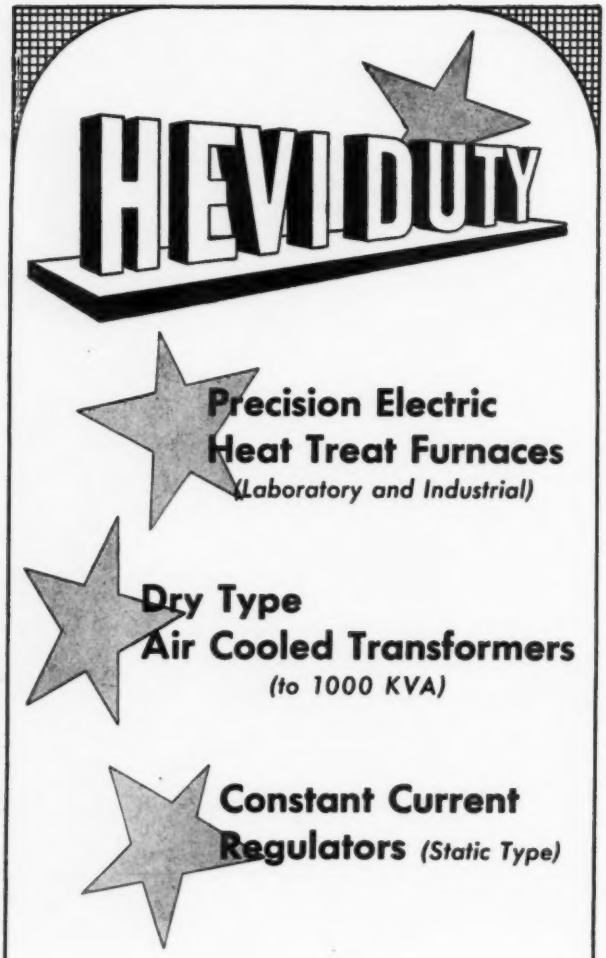
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Harold E. Koch, '22, President
Elton E. Staples, '26, Vice President

THE INSTITUTE GAZETTE

(*Continued from page 366*)

erty west of Massachusetts Avenue to student and faculty housing and recreation. In the event that all fraternities desiring land could not be accommodated, the committee suggested that the Institute consider the acquisition of additional land for lease to fraternities. It was recommended that this be done only if it is a sound investment for Institute funds.

The committee furthermore recommended certain basic requirements governing the utilization of land, as well as the type and size of the house. The report recommended that there be no development of a consolidated fraternity housing unit unless the fraternities themselves express a desire for such a building.

Title to any land leased to fraternities on a long-term basis should be retained by the Institute, the committee believes, with reasonable provisions for renewal, subletting, and for cancellation in the event a fraternity reduced its normal functions. In this event, there should be provisions for a fair payment to the fraternity for the house and improvements.

The Institute, the report said, should provide no financial assistance except in instances where such assistance would represent a sound investment for endowment funds.

Supervision of fraternities by the Institute, the report recommended, should be limited to financial supervision necessary for the protection of its investment, and architectural supervision to maintain designs consistent with the Institute's policy. This supervision should include actions which might be required to prevent impairment of the good name and reputation of the Institute, damage to its properties, or serious impairment of M.I.T.'s scholastic programs. Aside from this supervision the committee recommended that domination of fraternities should be avoided and that contacts between the Institute and the fraternities should be maintained to the maximum practical degree directly between the proper Institute authorities and the individual students.

Should the demand from fraternities for land exceed the amount of space available, the selection of the fraternities to participate should, the report recommended, depend upon the record of general con-

(*Continued on page 370*)

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79 Sidney Street, Cambridge 39, Mass.

THE INSTITUTE GAZETTE

(*Continued from page 368*)

tribution by the fraternity to the objectives of M.I.T., the soundness of the investment involved, as well as the need of each fraternity for a site on the Institute's campus. The latter problem could be considered on the basis of inaccessibility of present property, number of students involved, and inadequate quarters. The only land now available for such purposes is a plot on the east side of the Riverside Dormitory and another adjacent to the present Solar House.

The committee which made this study consisted of Donald F. Carpenter, '22, chairman; Francis J. Chesterman, '05; Edward S. Farrow, '20; Joseph W. Powell; and Henry E. Worcester, '97.

Commencement Speaker

JUDGE Harold R. Medina of the United States District Court, Southern District of New York, will deliver the principal address at the 85th commencement exercises at M.I.T. on Friday, June 8, 1951. Judge Medina, who is well known for many legal reforms affecting court procedure, will speak to more than 1,000 graduates in Rockwell Cage at M.I.T.

A member of the New York Bar Association, Judge Medina holds degrees from Princeton and Columbia Universities, and in 1947 was awarded the honorary LL.D. degree by St. John's College. He was admitted

(*Concluded on page 372*)

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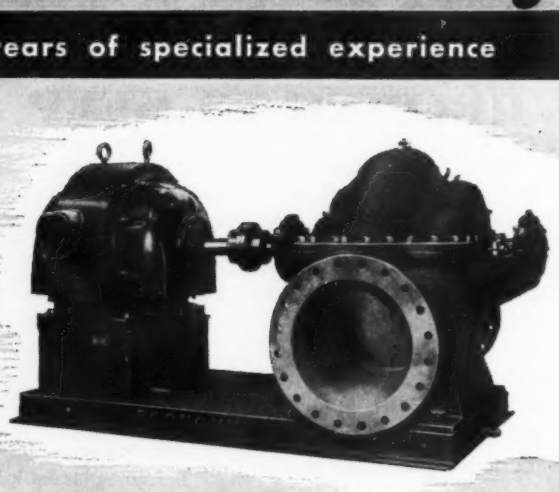

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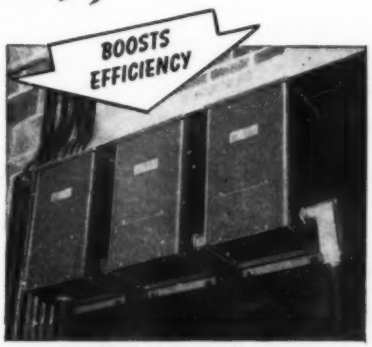

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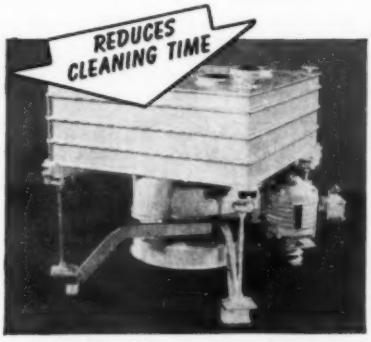
Induction Heater

Cuts heat treating, soldering, brazing, annealing costs. Fast, clean, saves floor space, can be integrated into production line, improves product quality. Companion dielectric heater heats non-conducting material, cures glue joints and preheats plastics.



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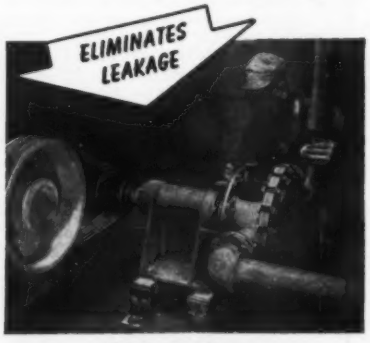

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THE INSTITUTE GAZETTE

(Concluded from page 370)

to the New York bar in 1912. Before his appointment as federal judge in 1947, he was active in the practice of law and a member of the faculty of Columbia University. Editor and author of numerous books and articles, Judge Medina is a member of many professional societies.

Librarians Meet

Host to approximately 150 librarians from colleges and universities throughout New England, M.I.T. welcomed the New England College Librarians on April 13 and 14 at their spring meeting which was held in the lounge of the Charles Hayden Memorial Library.

Plans for the two-day session were made by Vernon D. Tate, Director of Libraries at the Institute, and Robert E. Booth, Associate Librarian. Inspection of the library's facilities, informal talks, discussions, a program of folk music in the music library, and dinner at the Campus Room of the Graduate House were all a part of the program. Out-of-town guests were housed at Riverside, M.I.T.'s new dormitory.

Participating with Dr. Tate in the evening session on April 13 were Eugene B. Power, President of University Microfilms, and Fremont Rider, Librarian of Wesleyan University and chairman of National Microcard Committee.

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TWO FLEXIBLE HIGH-TEMPERATURE COAXIAL CABLES FOR USE ON AIRCRAFT AND ELECTRONIC EQUIPMENT

These cables are high-temperature modifications of standard Type RG cables which will withstand continual change in temperatures without damage to the insulation.

The insulation consists of the use of teflon tape applied in a unique manner and sealed from moisture and air. The tradename for this product is "Teflex" for which patent has been received. The characteristics of the insulation are such that the cable will withstand temperatures as low as –80°F and up to 500°F for long periods of time with very little deterioration in dielectric breakdown, power factor, attenuation, change in capacity or corona forming voltage.

These cables have been adopted and approved by ASESA as standard RG cables. The electrical and physical characteristics of these cables are as follows:

RG–115/U	ASESA NUMBER	RG–124/U
RG–8/U; 9/U; 9A/U	EQUIVALENT TO ASESA NUMBER	RG–59/U
COX–2FS–13–GV	BIW TYPE NUMBER	COX–3FS–026–GV
–65°C to + 250°C	TEMPERATURE RANGE	–65°C to + 200°C
#13 stranded silver-plated copper	CONDUCTOR	#22 copperweld
"Teflex"; diameter .250" plus or minus .005"	INSULATION	"Teflex"; diameter .135" plus or minus .005"
Double silver-plated copper diameter .300"	SHIELD	Single tinned copper diameter .180"
Double "Teflex" layer	MOISTURE SEAL	Single "Teflex" layer
Double fibreglass braid impregnated with silicone varnish	OUTER COVER	Single heavy fibreglass braid impregnated with silicone varnish
.370" plus or minus .010"	OUTSIDE DIAMETER	.240" plus or minus .008"
Blue tracer	BIW MARKER	Orange tracer
.14 lbs. per foot	NET WEIGHT	.05 lbs. per ft.
50 plus or minus 2 ohms	IMPEDANCE	73 plus or minus 3 ohms
29 plus 2 mmf/ft.	CAPACITANCE	20 plus 1 mmf/ft.
8,000 volts R.M.S.	MAXIMUM OPERATING VOLTAGE	2,300 volts R.M.S.
10,000 volts R.M.S.	CORONA VOLTAGE	7,000 volts R.M.S.
2.0 db per 100 ft.	ATTENUATION 100 mc/s	3.8 db per 100 ft.
5.6	400 mc/s	10.
15.4	3000 mc/s	29.
$2.00	LIST PRICE PER FOOT	$.75

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THE GREAT DREAM

(*Concluded from page 358*)

land had actually been seen: Lozier Bouvet's *Cap de la Circoncision*, south-southwest of Cape Town.

Because of the almost permanent bad weather just in that region, he missed the tiny island which is actually there, but the negative result was very positive when looked at from another angle: there was no land. Bouvet had made a mistake of some kind. Captain Cook himself believed that an iceberg had been the "cape."

The thing to do next was to sail around the earth, as far south as weather conditions, or *Terra Australis*, would permit. Captain Cook circled the South Pole systematically – half the Circle roughly along the 55th degree of southern latitude, and the other half at about 60 degrees. He crossed the Antarctic Circle three times. Sometimes small islands were seen during this trip, but almost always icebergs (some of them of fantastic size) were sighted. Once a gigantic ice wall appeared, behind which there might or might not be land.

His ships were not built for polar exploration, but Captain Cook went as far south with them as could safely be done with ordinary ships. The result of his expedition was: the great southern continent does not exist! It was possible that there was a much smaller Antarctic Continent under perpetual snow and ice, but that Antarctic Continent would lie completely inside the Antarctic Circle.

A Dream Ends

Terra Australis, which had begun with Hipparchus in antiquity, was destroyed for all time during that year 1775 when Captain Cook's ships returned to England, and when the Captain himself drew the conclusions from his observations. It is said that Buffon, then an old man, cried when he was informed about the results of this expedition. He stated later that such a continent, which was still possible after Captain Cook's journey, would hardly be worth the trouble of exploration.

It was the end of a long and beautiful dream – the dream of a marvelous continent just outside of the explorer's reach. The dream persisted even though the coast of that continent receded and receded again, and did not end until it was definitely proved that the grain of truth in it was buried under many, many yards of ice and snow inside the Antarctic Circle.

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There are some who think I *did* make it*. In any event, many have asked me how best to get a good start in life insurance selling.

Most important, I'd say, is to choose a company that wants to be sure you *will* make the grade—that (1) screens applicants carefully, and (2) thoroughly fits a new man for a successful career.

These two factors (plus a plan that supports you while you are just learning) are leading many ambitious younger men to New England Mutual today. The company gives each man three separate screening tests before taking him on. Just being able to pass those tests gives you confidence.

My own education began immediately and continued for several years while I was working. It goes about like this. First comes basic training in your agency, combining theory and field work. After selling insurance for a few months, you qualify for the comprehensive Home Office course given in Boston, with all expenses paid by your general agent and the company.

Next you'll take up Coordinated Estates—the professional approach to selling and servicing life insurance. Then, as you are ready for it, comes Advanced Underwriting, which covers business uses of life insurance, and relates insurance to wills, trusts, and estate planning, and to taxation problems—income, estate and inheritance. I jumped into this as soon as I could, and found it of tremendous help in dealing with business and personal cases involving substantial amounts of insurance.

Your final step, although I happened to take mine pretty early in the game, will be to study for your CLU designation, which is comparable to the CPA in accounting. You will profit from this study, as I have, and from the company's regular bulletins on new tax and estate laws suggesting valuable sales applications.

From experience I know a man can get ahead faster in a company with a sound training program. A thousand New England Mutual fieldmen from here to Honolulu will testify to this.

Finally, I know I've done better in life insurance than I might have in my former work. There are a great many other New England Mutual representatives who have done at least as well or a lot better than I've done. I'm glad to have the opportunity to tell the story for them.

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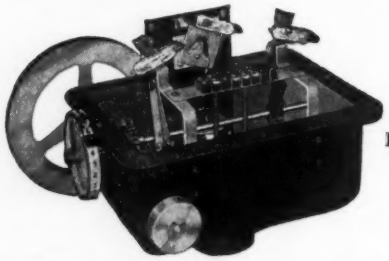

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THE MESQUITE TREE

(*Continued from page 352*)

called the 'golden period' of the Southwestern stockman. . . . During this intermediate decade there were fewer head of stock, wild or domestic, than at any previous period. There were also abundant rains and the seasons were mild and favorable to the full development of grasses."

Thus the stockman entered a "pastoral paradise," where grass was often "as high as a cow's back," and he never dreamed that the area could be overgrazed by cattle and sheep. But soon after 1883, the era of free ranges ended, fences were being built, and the Texas and Pacific Railroad — which rapidly helped to develop the stock industry — ran across the range country. Soon the lands were overstocked; the grasses suffered, but the tenacious mesquite flourished, beginning its threat to the new industry.

Along with the annual burnings and overstocking, other factors worked hand in hand to encourage the spread of mesquite: droughts, hard winters, and floods. With its deeper root systems the mesquite could survive bitter winters and droughts; whereas the grasses of the overgrazed ranges were seriously damaged. Floods transported mesquite seed to treeless areas, sometimes providing seedbeds of silt for germination.

At the turn of the century old-timers in Texas could point to mesquite thickets and say that these did not exist in their childhood; meanwhile ranchmen were beginning to look upon the encroachment with misgiving. Even then, however, it was not generally thought that the supremacy of grass vegetation would be endangered. In fact, the increasing acreage of forest cover seemed a blessing; it would "mitigate intense heat and equalize temperatures." Earlier, as the *Texas Almanac* for 1870 will show, most people believed that western Texas would become "much more seasonable than in its past history. It will never again be visited by such a series of droughts as desolated it in such a degree from 1856 to 1861. Uniform observation shows that the climate of countries, as to rain, is affected by the presence or absence of timber."

In 1895 the University of Arizona Agriculture Experiment Station praised the mesquite for its beneficence to arid regions: "Observation has shown that forests lower the temperature of warm countries, lessen extremes of temperatures, diminish the loss of

(*Concluded on page 378*)

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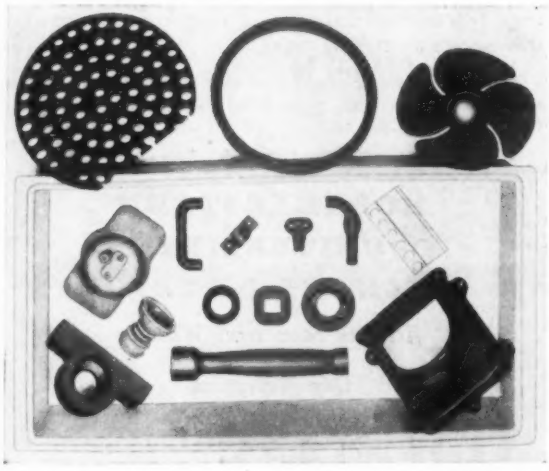

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The Technology Store

THE MESQUITE TREE

(*Concluded from page 376*)

water by evaporation, increase rainfall. . . ." Mesquite forests in Arizona were "too valuable for their products and their influence upon climate, to be carelessly destroyed."

Today range experts are searching for simple and economical methods of controlling and eradicating the tree that was once manna to a semiarid environment. The mesquite is now said to infest more than 70,000,000 acres of grazing land in the Southwest. It has been estimated that the cost of this mesquite invasion to Texas ranchers is over $30,000,000 annually.

Since 1936 experiments and tests for control have been made with water-soluble chemicals, oils, mechanical devices, and power machinery. Mesquite sprouts are killed with sodium arsenite and ammonium sulfamate sprays, while other chemical mixtures are being tested. When applied to root crowns, kerosene and Diesel and motor oils have been effective. Methods using mechanical clearing include bulldozers, power saws, and root-cutting devices.

The mesquite possesses a growth habit which makes control difficult and which probably accounts for the tree's ability to establish itself over such a wide area. Several inches beneath the soil, the mesquite's underground stem bears small wart-like structures known as buds or eyelets. These dormant buds, normally present on the cambium, regenerate sprouts when the top wood is killed. Closely connected with this growth characteristic is an appropriate legend mentioned by Frederick B. Page[5] in *Prairiedom* (published in 1845). "There is a legend that, as Aristonue was changed by the gods into myrtle after his death, so the Mexicans are turned into *muskeet trees,* and so far from fading, they possess the marvellous property of renewing themselves every few years."

[5] *Prairiedom: Rambles and Scrambles in Texas or New Estremadura,* [A. Suthron] page 129 (New York: Paine and Burgess, 1845).

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THE TREND OF AFFAIRS

(Continued from page 344)

interact with the motion in such a manner as to feed energy from the air stream into the vibrations of the structure. When such energy feedback develops, the amplitude of oscillation tends to build up to destruction. Because of the catastrophic nature of the flutter phenomenon, direct flight testing for the flutter speed has been avoided in the past, since it has been commonly assumed that the flight speed must be brought too near the dangerous flutter speed to obtain the required test data. Work done on small-scale elastic wind tunnel models indicates that this danger is no longer a requirement for testing.

A technique has been developed in the laboratory whereby response data, gathered at several speeds in the range below the onset of flutter, can be used in an extrapolation to determine the flutter speed. The technique involves the use of a small gun mounted on the wing tip. The reaction of the gun upon firing excites the wing, whose response is measured and recorded at several speeds safely below the flutter speed. When correlated with trends predicted by concurrently developed theory, the measured data can be extrapolated to yield the flutter speed. It is believed that the same technique can be employed in full-scale flight tests to obtain high-quality data without endangering the aircraft or its crew.

(Concluded on page 382)

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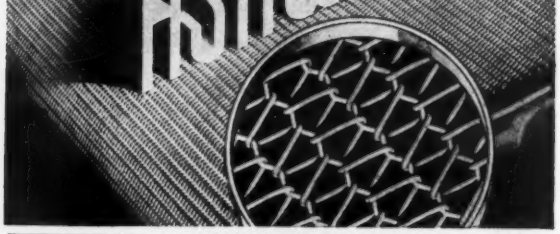

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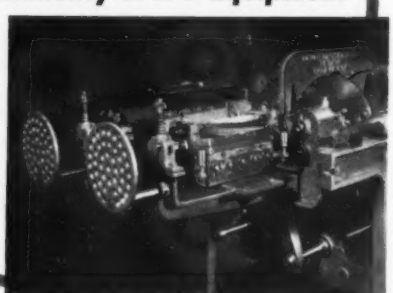

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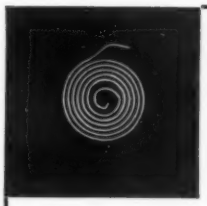

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THE TREND OF AFFAIRS

(Concluded from page 380)

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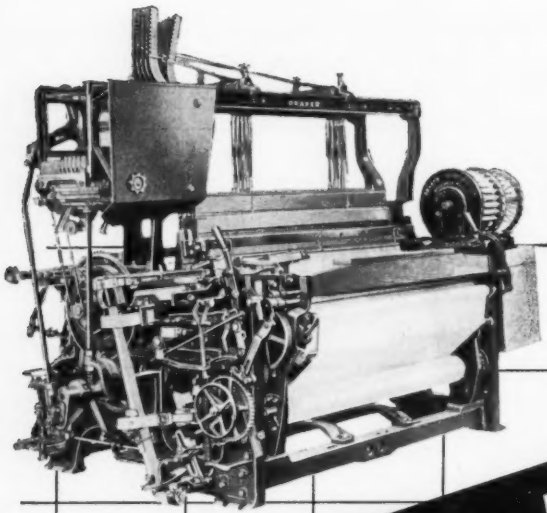
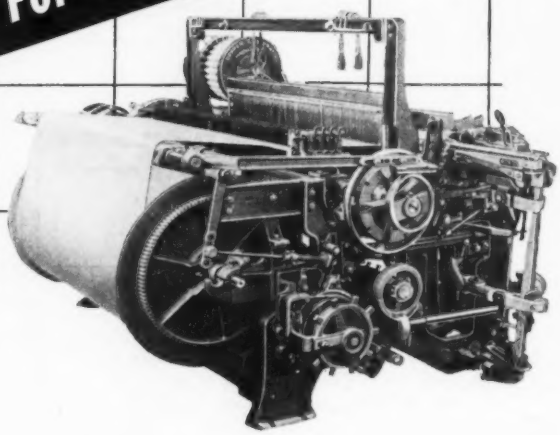


Rising Costs Call For Higher Production



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